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USSR Report

ENERGY

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USSR REPORT

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COAL INDUSTRY SUMMARIZES FIRST-QUARTER PRODUCTION FOR 1984

Moscow UGOL' in Russian No 6, Jun 84 pp 62-63

[Article from the Governing Board of the USSR Minugleprom: "Results of the Work of Coal Industry in the First Quarter of 1984"]

[Text] The governing board of the USSR Minugleprom [Ministry of Coal Industry] held a meeting in April of this year, during which the sector's work results for the first quarter of 1984 were examined and measures were planned for insuring fulfillment of the planned quotas of the 4th year of the five-year plan in light of the decisions of the April (1984) CPSU Central Committee Plenum and the First Session, 11th Convocation of the USSR Supreme Soviet, and the premises and conclusions contained in an address to the plenum by CPSU Central Committee general secretary, chairman of the Presidium of the USSR Supreme Soviet, Comrade K. U. Chernenko.

The planned quotas for the first quarter of 1984 were fulfilled by coal industry in relation to the principal technical-economic indicators. The coal extraction plan was 101.2 percent completed, with 2.1 million tons of coal extracted in excess of the plan, to include about 1 million tons of coking coal. The quota for tunneling preparatory drifts was surpassed by 55 km, to include 22 km of stripping and preparatory drifts.

The planned quotas for shale extraction, for coal processing at enriching factories, for production of concentrate and high grade coal, for product sales and for coal extraction productivity per worker and for the industry as a whole were fulfilled. The plan for labor productivity (the output of commercial product per worker) was surpassed by 1.1 percent in the USSR Minugleprom as a whole; compare this with the 0.9 percent that had been pledged. Labor productivity increased by 2 percent in comparison with 1983. Twenty-six coal and shale mining associations fulfilled counterplans for surpassing the labor productivity growth plan by over 1 percent and reducing product cost by 0.5 percent. Coal machine building plants improved their work, having fulfilled the standard net production plan (by 103.6 percent) and the plan for the basic nomenclature of mining equipment.

But at the same time there were shortcomings in the work of coal industry during the past period. Sixteen production associations did not complete their planned quotas, falling short by 1.5 million tons of coal. One hundred eighty-five mines and open pits, or 32 percent of their total, were unable to

complete the plan. The figures for completion of the coal extraction plan were only 83.3 percent for the Dzerzhinskugol' Production Association, 90.5 percent for the Antratsit Production Association, 93.6 percent for the Sakhalinugol' Production Association, 94.6 percent for the Pervomayskugol' Production Association and 95.9 percent for the Voroshilovgradugol' Production Association.

The Kuzbassugol' All-Union Production Association fell short of its plan for stripping and preparatory tunneling by 4.2 km, to include 186 meters of shafts, 1,348 meters of crosscuts and 2,160 meters of ramps.

The length of working faces dropped by 2 km in the Kuznetsk Basin and by 0.9 km in Karaganda in comparison with the first quarter of 1983. In the Ukrainian SSR Minugleprom, the average monthly rate of advance of working faces was 1.7 m less than planned, and 0.6 m less than in the first quarter of 1983.

Progress in achieving full mechanizing in the mining of steep seams is unsatisfactory in the Prokop'yevskugol', Kiselevskugol', Ordzhonikidzeugol' and Dzerzhinskugol' associations.

The fleet of extracting combines is being utilized significantly below the level of the established standards in the Ukrainian SSR Minugleprom, in the Kuzbassugol' All-Union Production Association and in the Karagandaugol', Kizelugol' and Sakhalinugol' associations.

The quota for the number of brigades attaining the one-thousand mark was failed by nine brigades in the Ukrainian SSR Minugleprom and by seven brigades in the Kuzbassugol' All-Union Production Association.

The Kemerovougol' and the Karagandaugol' associations failed their plan for stripping operations. While the USSR Minugleprom as a whole stayed within the planning indicator for ash content of shipped coal (26.2 percent), a number of the associations significantly exceeded it, to include: Rostovugol'--by 0.4 percent, Karagandaugol'--by 0.3 percent, Vorkutaugol'--by 0.3 percent, Krasnodonugol'--by 0.7 percent, Pavlogradugol'--by 0.6 percent, Donetskugol'--by 0.5 percent, Oktyabr'ugol'--by 0.6 percent.

The shortfall in the coal shipping plan was 0.6 million tons; if we consider the supplementary quota as well, this shortfall was 2.1 million tons.

Although the machine building plants did fulfill the plan for delivering mechanized complexes, extracting and tunneling combines and other equipment to the sector's enterprises in general, certain plants (Druzhkovka, Kamenka, Gorlovka, Aleksandrovka, Skopin) did not deliver scarce types of equipment and spare parts.

The new equipment introduction quota was not completed. Tests on combines of the unified series RKUP-25 in the Karaganda Basin and on combines of series 1 RKUP-20 in the Kuznetsk Basin are not proceeding satisfactorily.

In order to eliminate the existing shortcomings in the work of the sector, and with the objective of fulfilling the quotas planned for 1984, the governing board of the USSR Minugleprom adopted the following resolution:

1. Executives of the USSR Minugleprom, the Kuzbassugol' All-Union Production Association and the all-union associations, the general directors of production associations, the directors of mines, open pits, enriching factories and machine building plants, and executives of other enterprises and organizations must intensify their organizational efforts in the labor collectives with the objective of successfully fulfilling and surpassing the planned quotas, the counterplans and the socialist pledges for the second quarter of 1984 and for 1984 as a whole, turning special attention to the need for raising labor productivity, decreasing product cost and reducing material outlays.

Fulfillment of measures to insure stable operation of the sector's enterprises in the spring-summer period of 1984 must be placed under special control.

2. Deadlines must be established for compensating for the shortfall in coal extraction at the mines farthest behind, for fulfilling the quotas for making additional working faces operational in the second quarter of 1984, for compensating for the first quarter's shortfall in tunneling stripping and preparatory drifts in the mines, and for compensating for the shortfall in stripping operations at open pits.

The Ukrainian SSR Minugleprom, the Kuzbassugol' All-Union Production Association, the production associations and the construction combines and trusts must implement supplementary measures to insure fulfillment of the construction and installation plan and the plan for introducing all planned output capacities and facilities into operation by the set deadlines.

3. The Kuzbassugol' All-Union Production Association and the Karagandaugol' Association must examine the causes behind the decrease in productivity of tunneling combines jointly with the KuzNIUI [not further identified] and the Kuznetsk Scientific Research Institute of Coal, and determine ways to insure unconditional fulfillment of the quotas for combine tunneling volume planned for 1984.

4. In the second quarter of 1984 the Soyuzuglemash All-Union Production Association and the machine building plants must make up the January-March shortfalls in deliveries of equipment and spare parts to coal industry enterprises, and they must manufacture the additional equipment and spare parts needed.

5. The Dal'vostugol', Ekibastuzugol' and Kemerovugol' production associations and the Soyuzuglemash All-Union Production Association must improve the use of rail cars on the approach tracks of the enterprises.

6. General directors of associations that were unable to surpass the labor productivity growth plan by 1 percent and reduce the costs by 0.5 percent in the first quarter of 1984 must examine the reasons and implement additional

measures to insure unconditional fulfillment of the quotas for growth in labor productivity and for cost reduction established for the second quarter and for the period since the start of 1984.

7. The Ukrainian SSR Minugleprom, the all-union production associations and the productions associations must carefully inventory the above-standard and surplus stocks of salable articles and material valuables, and draw up and approve measures and schedules for introducing them into economic turnover.

Fulfillment of these measures will make it possible to correct the existing shortcomings and successfully fulfill the planned quotas of 1984.

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MINERAL FUELS INSTITUTE RECOLLECTS ITS 50-YEAR HISTORY

Moscow UGOL' in Russian No 6, Jun 84 pp 6-11

[Article by Candidate of Economic Sciences L. V. Semenov, Institute of Mineral Fuels: "Contribution of Scientists of the Institute of Mineral Fuels to Solving the Problem of Sensible Use of the USSR's Coal Resources (on the 50th Anniversary of the Institute of Mineral Fuels)"]

[Text] The sources and forms of primary energy sources used in social production are undergoing diversification as productive forces grow. The volume of mineral fuel extracted and consumed per capita and, in recent years, the amount of nuclear energy produced and consumed became integral economic indicators of the level of industrial development of all countries in the 20th century.

In 1922 the structure of our country's fuel balance was as follows: firewood converted to standard fuel units--44 percent, coal--30.3 percent, petroleum--22.5 percent, peat, shale and others--3.2 percent.

The plan of the State Commission for Electrification of Russia foresaw raising coal extraction to 62.3 million tons within 10-15 years. The task of increasing the volume of mineral fuels in the fuel balance was completed primarily through the use of coal, the extraction volume of which exceeded the prerevolutionary volume in 1927 and attained 76 million tons in 1933.

The quotas for development of the country's national economy in the 2d Five-Year Plan were approved in early 1934 at the 17th VKP(b) [All-Union Communist Party (of Bolsheviks)] Congress. Special attention was turned to building mines on a major scale, including in newly developed basins. The five-year plan called for placing 178 coal mines into operation with a total capacity of 143 million tons. By the start of the 2nd Five Year Plan, our country possessed significant resources for development of coal industry as a result of the great volume of geological prospecting completed in the previous five-year plan. In 1931 the balance reserves of coal in categories $A+B+C_1$ attained 20.6 billion tons, or 3.2 percent of the country's total geological reserves of that time (640 billion tons). We can note for comparison that according to a 1913 census these reserves were only 69 million tons on Russian territory, or 0.03 percent of the geological reserves on record at that time.

In the second Five Year Plan, it became possible to achieve broad industrial assimilation of the coal resources of the eastern basins and deposits with better mining conditions.

There was a requirement for the maximum possible number of scientists, and primarily coal chemists, to study the quality of coal and to develop progressive procedures of its use. The party's 17th Congress indicated the need for scientific research institutes to initiate the work, for developing chemical processing of solid fuels and for combining chemical industry with coke production.

The USSR Academy of Sciences joined the effort to solve the problems of socialist industrialization in these years. However, its inventory of leading scientific institutions did not include an institute that specialized in integrated study of the country's coal, oil and other fuel resources. The narrowly specialized Sapropelev Institute that was in existence at the time could not solve such problems. Academician I. M. Gubkin turned his attention to this opportunely. A prominent soviet scientist and a world-famous geologist who headed the state's geological service from 1931 to 1939, Gubkin felt it necessary to conduct a complex of fundamental research on the geochemistry of mineral fuels and to study the origin and laws governing formation of deposits of caustobioliths and the composition and properties of hard and soft coal, combustible shale, petroleum and bitumen. He prepared a proposal for creating the Institute of Mineral Fuels (the IGI of the USSR Academy of Sciences) out of the Sapropelev Institute with the tasks of conducting experimental research and developing the scientific principles of sensible use of all forms of mineral fuels. On 5 July 1934 the Presidium of the USSR Academy of Sciences approved these proposals and instructed Academician I. M. Gubkin to make the necessary preparations. A resolution of the Presidium of the USSR Academy of Sciences creating the IGI was adopted on 18 December 1934.

Scientists of the IGI made a great contribution to the study and development of the resources of new coal basins and deposits, which became the country's dependable crude fuel base during the Great Patriotic War. Examples of the swift discovery and development of coal resources necessary for development of power engineering, metallurgy and chemical industry include:

The Karaganda Basin, in which the total reserves of just 8 billion tons estimated in 1930 increased to 50 billion tons in 1934, and by as early as 1934-1937 the large mines that were built here produced their first few million tons of coal;

The Prokopyevsk-Kiselevsk and Osinniki regions of the Kuznetsk Basin, in which exploration of the mining zones was basically completed in 1935, and which became the country's largest coking coal base in the most difficult years of the Great Patriotic War;

The Vorkuta deposit of the Pechora Basin, which was industrially developed and which began supplying fuel to the Northern Fleet in 1937, and to the country's central regions and the Urals beginning in 1941.

The solution of these and other practical problems became possible owing to the concern of the party and government for developing fundamental research in all areas of science, to include integrated study of solid fuel resources and development of the chemical technology of solid fuels. The great contribution made by scientists of the IGI to this direction is universally recognized.

The scientific works of institute director Academician I. M. Gubkin and his talented colleagues--academicians N. D. Zelinskiy, S. S. Nametkin and N. P. Chizhevskiy, USSR Academy of Sciences corresponding members S. F. Fedorov, L. M. Sapozhnikov, N. M. Karavayev and M. A. Kapelyushnikov, professors B. K. Klimov, V. A. Lanin and G. L. Stadnikov and others--became widely known in the prewar period.

The 1930s were characterized by the flourishing of the Soviet science of coal petrography. Professor I. I. Ammosov, the oldest colleague of the IGI, is rightfully said to be one of the founders of this science. Prior to 1930 coal was studied only as thin transparent sections in transmitted light. Ammosov was the first to begin studying Kuznetsk coal under a microscope as polished sections in reflected light. The study of the structure and composition of coal became an independent science. At first it was purely descriptive in nature, and it was called petrography; soon after, it began working on important theoretical and practical problems, though now under a new name--coal petrology. Study and development of no coal basin would be imaginable today without petrographic research on coal, necessary for solving the principal applied problems of its prospecting, extraction and sensible use--for example when determining the quality of coal, developing enrichment systems and so on.

Professor I. V. Yeremin established the possibility of assessing, on the basis of petrographic research, the suitability of coal for coking and enriching, and the degree of its oxidation. A method of assessing the degree of metamorphism of coal on the basis of the reflectivity of vitrinite was developed and introduced on a wide scale.

There are unforgettable pages in the history of the IGI which carefully preserve the memory of several generations of its colleagues. Both veterans and young researchers who had recently graduated from institutions of higher education and who had completed their graduate work are proud of the institute collective's great contribution to strengthening the country's defense potential during the Great Patriotic War.

All of the IGI's activities were directed from the first days of the war at rendering practical assistance to enterprises of coal, coke by-product , metallurgical and other sectors of heavy industry in raising the output of products necessary for production of arms and ammunition. Scientists of the IGI provided help in completing the important task of providing coal to the country. During the war, coal extraction grew by 40 percent in the country (less the Donets Basin), by 37 percent in the Kuznetsk Basin, by 79 percent in the Karaganda Basin and by 114 percent in the Urals. Special attention was turned to developing extraction of coking coal: by the end of the war it more than doubled in the country's east.

The country's first geological coke by-product map of the Prokopyevsk-Kiselevsk coal region was created on the basis of research conducted on coal of the Kuznetsk Basin back in the prewar years by scientists of the IGI together with I. I. Ammosov, O. I. Yegorova, N. M. Karavayev, L. M. Sapozhnikov, N. G. Titov and others. It was used during the war to predict the properties of coal from new seams and mining areas; workers of the Kuzbassugol' Combine and mine geologists used it to increase extraction of brands of coal that were most valuable to the coke by-product industry.

In 1941 the plastometric method of investigating the suitability of coal for coking, developed by the IGI, was approved as the standard. This made it possible to avert mishaps in Dinas coke ovens resulting from exceeding the bursting pressure. Not only was this method used extensively to detect "dangerous" coal, but it was also employed to make up coking charges on a scientific basis, which made it possible to use the more abundant gas and weakly caking coal to obtain scarce metallurgical coke.

The party and government posed the task of satisfying the demand of metallurgical and defense industry for coke and chemical products more fully by plants in the eastern regions. During the war 13 coking batteries were built here together with coke by-product trapping and processing shops using equipment evacuated from western regions. This made it possible to increase coke production from 5,382,000 tons in 1940 to 10,526,000 tons in 1945. An increase in production of toluene, which could be practically obtained only in conjunction with coking processes at that time, had special significance. It was needed as a means for increasing ammunition production.

In 1941-1942 scientists of the IGI conducted research at a plant in Kemerovo in cooperation with scientists of other institutes on the technology of pyrolysis of microquantities of petroleum products together with a coal charge in coke ovens. Introduction of this technology into all coke by-product plants of Siberia and the Urals made it possible to raise their total productivity with respect to coke and chemical products by 4-6 percent as early as in 1942, without additional capital investments. In short time toluene production doubled at the Magnitogorsk and Nizhiy Tagil metallurgical combines. The authors of this original method were awarded the USSR State Prize in 1946; one of them, Doctor of Technical Sciences S. M. Grigor'yev, is now working in the institute as a consultant.

In 1943 the USSR Gosplan ordered the IGI to draw up proposals for sensible use of Kuznetsk coking coal and coke and for further intensification of production at the Magnitogorsk, Nizhiy Tagil and Kuznetsk metallurgical combines and the Kemerovo Coke By-Product Plant. Under the guidance of L. M. Sapozhnikov the institute's scientists demonstrated the possibility of obtaining metallurgical coke from the charges containing a higher concentration of more-abundant coal from mines of the Leninugol', Prokop'yevskugol' and other combines. Blast furnaces began operating with a lower coke consumption while simultaneously surpassing the cast iron production plan. Expansion of the raw material base of coking and acceleration of the oven operating cycle involved certain difficulties elicited by the heterogeneity of the petrographic composition of the coal, by change in its properties due to varying degrees of metamorphism even

within the area of a single coal mine, and by the fact that seams near oxidation zones were included in the mining effort during the war. Therefore organization of mass express control of the caking ability of coal acquired special significance. In response to a proposal from the USSR people's commissariats of coal industry and ferrous metallurgy having the objective of quickly establishing the suitability of coal for coking, the All-Union Committee for Standards approved GOST [All-Union State Standard] 2013-43 for a quick method developed by the IGI for determining the caking ability of coal. The institute's seniormost colleague, Ye. M. Tayts (presently a professor and a doctor of technical sciences) proposed the design of a coal testing apparatus that could be manufactured by the enterprises themselves. The IGI's quick method came into wide use in coal industry. The apparatus was installed in laboratories of trusts in the Kuznetsk Basin as well as at some large mines.

Use of the quick method for determining the caking properties of coal (as a supplement to plastometric analysis) made it possible to supply production with coke of the needed qualities and with constant properties, which was especially important to raising the productivity of blast furnaces.

In June 1943 a decision was made at a meeting of representatives of the People's Commissariat of Coal Industry, the People's Commissariat of Ferrous Metallurgy and the All-Union Committee for Standards to initiate wide use of a procedure proposed by L. M. Sapozhnikov for sorting coke with respect to size. Its introduction at the Kuznetsk Metallurgical Combine reduced coke consumption by 5 percent and raised the productivity of blast furnaces by 7 percent. On instructions from the USSR Gosplan a new organizational chart was adopted for coke production at the Chelyabinsk and Orsk-Khalilovo Metallurgical Plants and the second generation of the Kuznetsk Metallurgical Combine, then under construction.

Nor can we neglect to mention the contribution of the collective of the IGI to restoring coal and coke by-product industry in regions liberated from the enemy. Fast start-up of coke by-product plants in the Donets Basin required, first of all, organization of coking coal extraction at numerous small mines, and sensible use of this coal. In October 1943 a group of colleagues from the IGI visited the Donets Basin. By as early as the end of November the scientists had surveyed the coal of 130 mines, revealed the resources needed for start-up of priority facilities and composed the charges for them. The coal enriching factory and coking battery in Yenakiyevo were the first to be restored in the liberated basin. As of 14 December 1943 the country began to receive Donets coke once again.

Because mining proceeded in the Donets Basin at small mines and in seams lying not very deep, operational evaluation of the caking ability of coal using the IGI method made it possible not only to distinguish coal suited for production of coke having optimum physico-mechanical properties, but also to detect non-caking and oxidized coal. Workers of the basin's coal industry were provided significant assistance, and they were given guidance in selecting areas in which to build new mines and in which to deepen existing mines. In 1943-1944 IGI apparatus was installed at the Gorlovka, Kadiyevka, Makeyevka, Rutchenkovo and other coke by-product plants of the Donets Basin.

In addition to traditional forms of organizing scientific work, special commissions, expeditions and brigades were widely employed during the war. They brought together scientists and specialists from different scientific institutions and departments, which provided a possibility for efficiently solving many problems concerned with providing scientific and technical assistance to industry. Many colleagues of the IGI worked as members of government commissions and a commission of the USSR Academy of Sciences for mobilizing the resources of the Urals, Siberia and Kazakhstan for defense needs. The Commission for Mobilizing Resources of the Kama and Volga Regions for Defense Needs was created in May 1942. The fuel resources section of this commission was headed by the director of IGI, Academician S. S. Nametkin. Together with scientists of other scientific institutions of the USSR Academy of Sciences, colleagues of the institute's laboratories evacuated to Kazan participated in research on and development of brown coal, oil shale and peat from the Bashkir, Mari, Tatar and Chuvash autonomous republics and Kuybyshev Oblast for power production needs. The efforts of this commission to study oil deposits had especially great significance to the country's defense.

Scientific colleagues of the IGI worked in 10 field detachments of the Volga-Bashkir oil expedition headed by S. F. Fedorov. The results of the field work and of geochemical and other studies demonstrated the presence of industrial reserves of oil in the Tatar ASSR. The opening of the Shugurovo deposit to exploitation made it possible to increase oil extraction to 500,000 tons by as early as 1944. In that same year rich Devonian oil deposits were discovered in Kuybyshev Oblast, and oil extraction increased fourfold in this area. Discovery of Devonian oil not only made it possible to supply the most important strategic raw material for defense needs but also created the groundwork for swift development of the sector in the postwar era.

The institute's efforts to improve the procedures of obtaining high-octane aviation fuel and lubricants suitable for use at low environmental temperatures had great significance.

One of the forms of participation of IGI colleagues in scientific and technical development of industrial enterprises during the war was work in plant research laboratories. Thus V. Ye. Glushnev's group at the Moscow Neftegaz Plant worked jointly with producers to create a domestic procedure for producing oil used in hydraulic systems of combat equipment (shock-absorber fluid) and to organize its production in short time.

Solid fuels continued to dominate in the explored reserves of mineral fuels in the postwar era. In accordance with the five-year plan's quotas for restoring and developing the USSR national economy in 1946-1950, coal and oil shale provided for the bulk of the growth in fuel extraction in the country. By as early as 1948 the fuel industry returned to its prewar level, and the proportion of coal in the country's fuel balance was 60 percent (Figure 1).

The year 1948 became an important landmark in the history of the IGI. The laboratories of the Institute of Power Engineering imeni G. M. Krzhizhanovskiy, which were developing the chemical technology of solid fuels, were transferred to it, and the Petroleum Institute of the USSR Academy of Sciences was organized

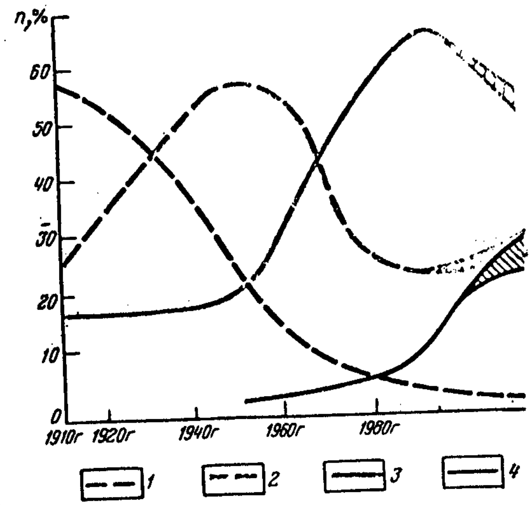

Figure 1. Approximate Structure of the Use of Energy Resources in the USSR: 1--wood fuels; 2--coal; 3--oil and natural gas; 4--hydroelectric and atomic power

out of several IGI laboratories dealing with oil geology and refining. A. B. Chernyshev, an academician of the Estonian SSR Academy of Sciences, a corresponding member of the USSR Academy of Sciences and a prominent scientist in the field of the use of solid fuels for power and chemical production, became director of the IGI. Creation of the world's largest shale processing industry in the country's northwest was an important national economic task in which the collective of the IGI participated at that time. Materials of scientific research and experimental industrial developments that were begun back in the prewar era by colleagues of the IGI--B K. Klimov, V. A. Lanin, Ye. I. Kazakov, M. V. Pronina and others--were extensively used in the planning and construction of shale and chemical enterprises. It should be noted that as early as in 1939 the first lot of shale gasoline was obtained at a plant in Gdov on the basis of a procedure developed by the IGI. A motor rally over 1,000 km long was organized using this gasoline. The rally demonstrated the good motor qualities of shale gasoline.

Utilization of the experience of IGI scientists in research on Baltic shale, and of sensible procedures for processing it, tested by the institute, promoted acceleration of the development of a new sector in the Estonian SSR. By 1955 oil shale extraction in the republic exceeded the prewar level by a factor of 3.5, attaining 9 million tons. After thermochemical shale processing was organized, Leningrad and Tallinn could be supplied with household gas (up to 1 billion m^3 per year).

The coal industry continued to develop at a high rate during this period. During 1951 to 1955 coal extraction increased by one and one-half times.

Research on the molecular structure of coal started in the institute back in the 1930s by G. L. Stadnikov, N. M. Karavayev and other scientists enjoyed further development during these years. Physical research methods were used to study the molecular structure of coal, making it possible to obtain important results having great theoretical and practical significance (V. I. Kasatochkin, N. G. Titov and others).

Between 1953 and 1964 the IGI was headed by Doctor of Chemical Sciences N. G. Titov. In compliance with decisions of the 19th CPSU Congress on bringing industry closer to the sources of raw materials, fuel and power and on developing the fuel and energy resources of eastern regions, colleagues of the IGI participated actively in expeditions of the USSR Academy of Sciences to study coal in the Kansk-Achinsk, Minusinsk, Tungus, Taymyr, Irkutsk, Lensk, Southern Yakut, Ulug-Khem and other basins and deposits.

Coal chemists of the IGI worked at the Neryungri deposit as part of a coal technology detachment of the Southern Yakut integrated expedition of the USSR Academy of Sciences headed by I. N. Nikolayev. In the period from 1950 to 1955 they gathered and studied about 500 samples of coal from natural exposures on the bank of the Berkakita River and from drifts. Systematic study of the chemical and technological properties of Neryungri coal and its experimental industrial testing showed that it could be used in coke by-product industry. But because oxidation zones were present in the Moshchnyy seam, research was continued for a few years more. To insure the accuracy of their results, IGI scientists under the guidance of I. V. Yeremin used all known methods to study the properties of this coal, employing samples taken from exploratory shafts. It was established that three-fourths of the deposit's reserves could be used to produce metallurgical coke. Coal from all deposits of the Minusinsk and the Kansk-Achinsk basins was studied in laboratories of the IGI, its qualitative characteristics were determined, and prospective consumers were revealed. As a result substantiated proposals were made for construction of open coal pits at the Chernogorsk, Izykhskiy and Beyskiy deposits of the Minusinsk Basin and for increasing the output capacity of open pits in the Kansk-Achinsk Basin.

Research on a number of new coal basins and deposits and expansion of the prospects in previously discovered deposits opened up great possibilities for concentrating production in coal industry and developing open pit coal mining. As a rule the rate of increase of proven coal reserves surpassed the rate of their industrial development.

Analysis showed that in 1951 only 1.7 percent of the coal of the Kansk-Achinsk Basin was being developed, despite the fact that this basin contained the largest resources and open pit mining was possible with minimum stripping. Consider also that it was in the 1950s that the structure of the country's fuel balance began changing in connection with the discovery and development of large deposits of oil and natural gas, that the possibilities of wide utilization of coal in the national economy depended primarily on improvements in economic indicators of coal mining.

This situation was brought about by a number of objective causes. Despite the fact that Kansk-Achinsk coal has a low ash content and that in comparison with brown coal from the country's other basins it has the highest heat of combustion, the economically effective radius of its shipment was limited to some-

thing on the order of 1,500 km. When transported for greater distances it enters the zone of consumption of other economical resources, and becomes unfeasible because of the fuel expenditures required. The distance between the Kansk-Achinsk and other eastern basins in which highly economical coal reserves are concentrated, and resource-scarce regions of principal fuel consumption attains 4,000-5,000 km. Given this distribution of coal resources, their effective development on a unionwide scale depends entirely upon solving the problem of obtaining fuel products with higher heat of combustion and better transportability from coal processing industry and on creation of economical power transmission lines for the transport of energy over ultralong distances.

Scientists of the IGI are employing a wide complex of methods of directed influence upon the organic mass of coal in order to solve the problem of achieving sensible use of coal resources (Figure 2). The principal methods are: breakdown by reduction, breakdown by various chemically active reagents; thermal and oxidative breakdown. The greatest successes in creating new coal processing systems were achieved with breakdown processes involving reduction. Synthetic coal chemistry is developing on the basis of use of the breakdown products. The IGI is the country's sole institute that has been continually conducting theoretical and experimental research on breakdown by reduction and on hydrogenational catalytic coal processing for 50 years. The general theory of reduction breakdown of solid fuel and hydrogenational processes developed by the institute enjoyed wide recognition in the country and abroad.

Catalysis became the principal method of many chemical processes in the 20th century. Today over 70 percent of all chemical processes performed in industry are catalytic. One of the founders of the teaching on organic catalysis and catalytic synthesis is Academician N. D. Zelinskiy, a prominent Soviet scientist. He was a member of the Scientific Council of the IGI, and he took an active part in its proceedings in 1934-1941. It may be concluded from a study of Zelinskiy's archival materials and publications that his research on hydrogenation catalysts laid the foundation for research that subsequently led to the creation of methods for processing the heavy petroleum fractions of oil shale, and then coal. Zelinskiy conducted his experiments with a nickel catalyst applied to aluminum oxide. Shale tar with a sulfur content of up to 12-13 percent was successfully processed.

During the war ways were found to raise the octane rating of motor fuel owing to research on catalytic synthesis by N. D. Zelinskiy and N. I. Shuykin, and IGI colleagues B. K. Klimov and V. A. Lanin developed an industrial method of desulfurization of Ishimbay gasoline involving catalytic vapor-phase purification. Its introduction helped in organizing production of cracked gasoline with an octane rating of 89-90.

A group studying the chemistry and kinetics of catalytic transformations of individual compounds having a chemical structure typical of that of solid fuel at high hydrogen pressure and studying the chemistry of solid hydrogenation was organized at the IGI in 1936. Headed by A. V. Lozovoy, the group was later reorganized as a laboratory.

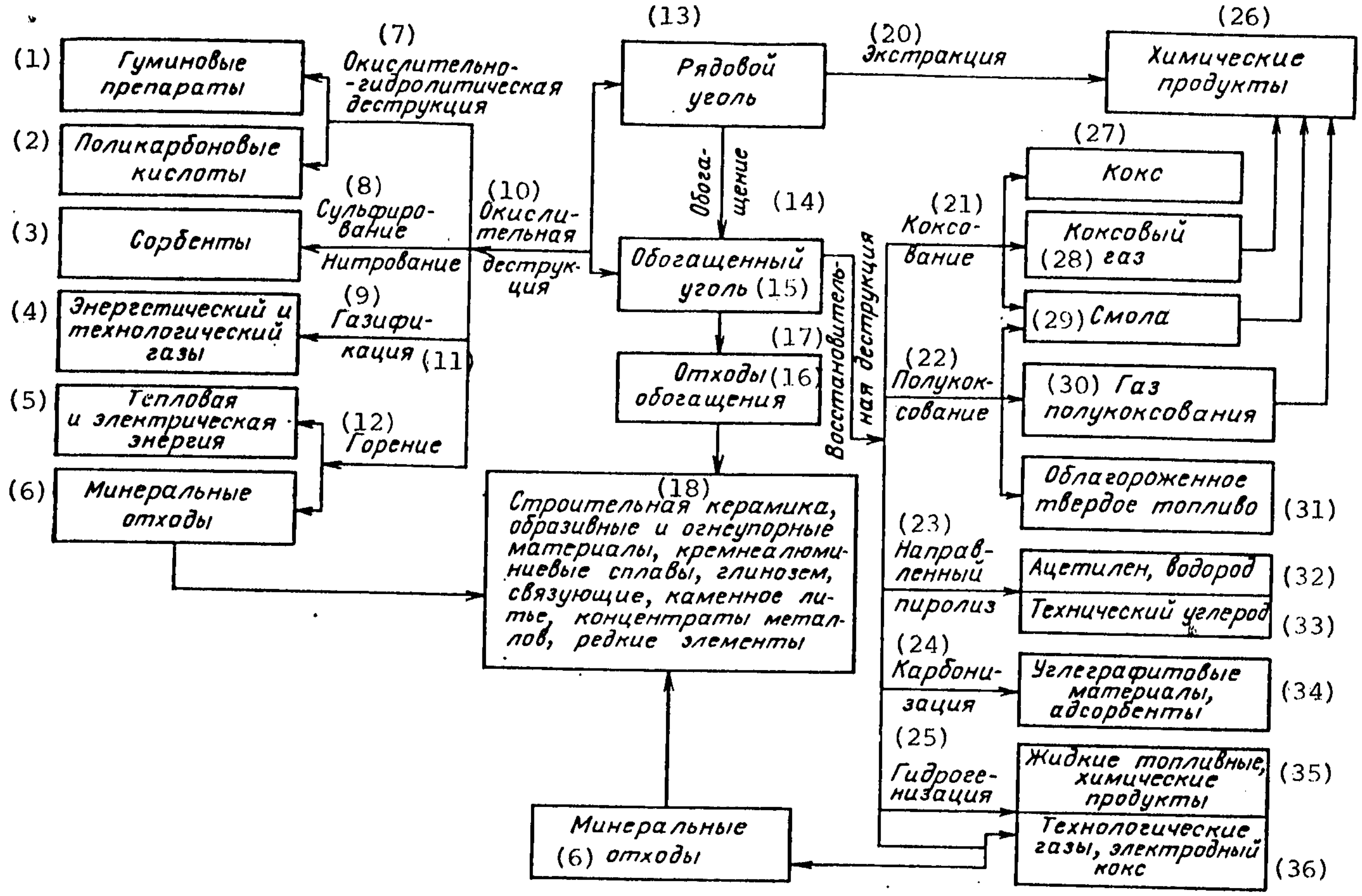

Figure 2. Basic Directions of Coal Processing and Utilization

Key:

1. Humic preparations
2. Polycarbonic acids
3. Sorbents
4. Gases for power production and industry
5. Thermal and electric energy
6. Mineral wastes
7. Oxidative-hydrolytic breakdown
8. Sulfation
9. Nitration
10. Oxidative breakdown
11. Gasification
12. Combustion
13. Commercial grade coal
14. Enrichment
15. Enriched coal
16. Enrichment wastes
17. Breakdown by reduction
18. Structural ceramics, abrasive and refractory materials, silicon-aluminum alloys, aluminum oxide, binders, cast stone, metal concentrates, rare elements
20. Extraction
21. Coking
22. Semi-coking
23. Directed pyrolysis
24. Carbonization
25. Hydrogenation
26. Chemical products
27. Coke
28. Coke gas
29. Tar
30. Semi-coking gas
31. Refined solid fuel
32. Acetylene hydrogen
33. Technical grade carbon
34. Coal-graphite materials, adsorbents
35. Liquid fuels, chemical products
36. Industrial gases, electrode coke

In the late 1960s the IGI made predictions of the availability of mineral fuels in our country and analyzed the long-range trends in fuel use. This work demonstrated that many liquid hydrocarbons, and especially diesel fuel, gasoline and its fractions, which are raw materials used in organic synthesis, may become scarce. The proportion of petroleum and gas in the total increase in fuel extraction decreased during the 9th Five-Year Plan, while the proportion of coal increased. A unit of increment in oil and gas extraction cost the national economy 28-60 percent more than in the 8th Five-Year Plan. At the same time the economics of coal mining were observed to improve in coal industry owing to development of open pit mines, which were responsible for 72 percent of the increment in coal extraction in the 9th Five-Year Plan.

Research conducted by the IGI showed that the principal shortcomings of the classical system of hydrogenational coal processing were high pressure and high hydrogen consumption. Only by reducing pressure and hydrogen consumption could we have counted on reducing capital investments into production and product cost. Dehydrogenation of naphthene hydrocarbons, tetrahydronaphthalene for example, a process that occurs simultaneously with hydrogenation of coal by hydrogen, could have become a simple method of saturating the organic mass of coal. But calculations showed that use of tetrahydronaphthalene and other similar individual hydrocarbons for these purposes in industrial conditions would be economically unfeasible. In 1967 Doctor of Technical Sciences A. A. Krichko used crude oil containing significant quantities of naphthene hydrocarbons for this purpose. Development of the scientific principles and technology of hydrogenating coal in a mixture with high-sulfur petroleum products was begun under his leadership. Use of a petroleum product--a hydrogen donor, organic additives and an active catalyst made it possible to achieve coal liquefaction at a pressure of 10 MPa with little gas formation (7-10 percent) and with 2 percent lower hydrogen consumption. For practical purposes it can be obtained by conversion of hydrocarbon gases formed during coal liquefaction. Transformation of the organic mass of coal attains 95 percent while the liquid product yield is 85-90 percent.

Economic studies conducted by the IGI in 1975 made it possible for the first time to arrive at conclusions concerning the prospects of obtaining synthetic liquid fuel by combining coal hydrogenation with desulfurization of crude oil while simultaneously reducing pressure and hydrogen consumption.

The energy crisis that developed in the capitalist world in 1973-1974, subsequent complications in oil supply and growth of oil and natural gas prices were a reflection of the inconsistency between the world oil resources and the structure of the energy balance of capitalist countries, and they brought on a flood of predictions concerning development of the production of synthetic fuel.

It became clear in this situation that the era of cheap oil had ended.

In our country, much attention is being devoted to sensible use of fuel and energy resources. Decisions of the 26th CPSU Congress posed the task of thoroughly studying the issue of producing synthetic liquid fuel out of coal

from the Kansk-Achinsk Basin. Two experimental industrial hydrogenation facilities using production procedures developed by the IGI are now being erected. Their productivity will be 5 and 75 tons of processed coal per day respectively.

The institute's scientists and engineers are providing scientific assistance, and they are coordinating the planning and design associated with building these facilities and manufacturing the equipment.

The basic premises of the USSR's long-range energy program foresee an optimum combination of different methods of transporting large quantities of energy resources to the European part of the country primarily from Siberia, where the principal increment in organic fuel extraction is to occur.

A significant quantity of Kansk-Achinsk brown coal will not only be used in power production (with the objective of transmitting electric power to the west), but it will also be processed into forms of enriched fuel with quality and economic indicators making its transportation possible. Of all forms of coal processing products, liquid fuel is the most effectively transported: a ton of liquid fuel is equivalent to 3 tons of brown coal from the Kansk-Achinsk Basin--that is, the transportation volume (reckoned in ton-kilometers) is reduced to a third. Moreover pipeline transport of fuel is significantly more economical than rail transport; relative outlays to transport energy by oil pipelines are lower by several orders of magnitude than the cost of using gas pipelines. On the other hand use of motor fuel and liquefied gases produced by hydrogenating enterprises processing Kansk-Achinsk coal right in East Siberia would make it possible not only to halt importation of these products into this region from West Siberia but also to send additional released resources into the European part of the country.

Successfully solving the problems of coal chemistry and its current and long-range tasks, the collective of the Institute of Mineral Fuels is making a significant contribution to scientific-technical progress and to development of the country's productive forces.

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METHOD PROPOSED FOR CALCULATING COST OF MINE CONSTRUCTION

Moscow UGOL' in Russian No 6, Jun 84 pp 12-13

[Article by Candidate of Technical Sciences I. P. Romashkin and Candidate of Economic Sciences M. P. Shmatkov, All-Union Central State Institute for the Planning and Technical-Economic Prerequisites for the Development of Coal Industry: "Assessment of the Cost of Building Mines in the Donets Basin in Early Planning Stages"]

[Text] The estimated cost of mines must be evaluated by simple, approximate methods when considering various solutions in the early stages of mine planning (the master plan for the sector's development, the technical-economic substantiation of detailed exploration, the technical-economic substantiation of conditions and so on), so that the variant selected for stripping, preparing and developing the deposit and other basic parameters of the mine could be optimized.

Creation of simplified methods of approximate evaluation of the estimated cost of mines may be of assistance in analyzing the structure of the total estimate. Such analysis was performed on 23 plans for new large mines in the Donets Basin working flat and tilted (up to 35°) seams 0.55-2.5 m thick (the plans were completed in 1970-1979). The planned annual capacity of the mines was 1.2-4 million tons, and the estimated cost was 33-312 million rubles.

Let us define the structure of the estimated cost as the relative distribution of outlays (percent) among 12 items of the total estimate, unforeseen outlays and proportionate participation in construction of local facilities--that is, in relation to a total of 14 outlay groups. This structure may be determined for each of the 23 plans for new mines under analysis using the formula:

$$\sum_{i=1}^{14} P_{ij} = 100, (j = 1, 2, \ldots, 23), \qquad (1)$$

where P_{ij} is the relative share of outlays in outlay group i for project j, percent.

When we determine the structure in this way, we essentially expand the scale in such a way that differences in the absolute values of the estimated cost of different facilities are excluded. Note that this operation does not have an effect on the ratio of the cost items to each other, because

$$P_{ij}/P_{kj}=S_{ij}/S_{kj}, \qquad (2)$$

where P_{kj}--relative share of outlays in group k for project j, percent; S_{ij}, S_{kj}--absolute value of outlays of correspondingly groups i and k for project j, rubles.

The transition to this structure noticeably reduces the scatter (standard deviation σ) of the values in each of the groups. If the coefficient of variations in the absolute values of outlays is $k_v(S_i)=\sigma(S_i)/\bar{S}_i$ and if the coefficient of variation of the structure is $k_v(P_i)=\sigma(P_i)/\bar{P}_i$, then the decrease in the coefficient of variation accompanying the transition to relative values would be

$$k_v(P_i)/k_v(S_i)\approx[\sigma(P_i)/\sigma(S_i)]\,\bar{\Sigma}, \qquad (3)$$

where $\bar{\Sigma}=\bar{S}_i/\bar{P}_i$--average estimated cost of one facility, rubles; $\sigma(S_i)$, $\sigma(P_i)$--standard deviations of S_{ij} and P_{ij} respectively. Thus fluctuations in the proportions of the estimated cost (in terms of its structure) are significantly smaller than fluctuations in the absolute values of outlays in the different groups: In this sense the cost structure is significantly stabler than the absolute values of the outlays. Thus for example for item 2, $k_v(S_2)=0{,}61$ and $k_v(P_2)=0{,}085$, which means more than a sevenfold decrease in scatter.

The statistics of the estimated cost structure are shown in Table 1.

Table 1

(1) Группа затрат	(2) Главы сводной сметы												Непредвиденные затраты (3)	Затраты на районные объекты (4)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
(5) Средняя доля группы, %	0,7	58,3	9,0	4,3	4,3	2,5	0,6	5,7	7,0	0,3	0,1	1,6	4,4	1,2
(6) Среднеквадратическое отклонение, %	0,88	4,84	2,24	0,93	2,44	1,42	0,21	2,23	1,31	0,083	0,273	2,066	2,605	2,757
(7) Минимальная доля группы, %	0,04	46,8	5,0	3,0	1,0	0,4	0,21	2,9	3,0	0	0	0	0,9	0
(8) Максимальная доля группы, %	3,4	65,6	13,1	6,2	9,8	4,0	0,95	10,2	9,8	0,55	1,3	11,0	8,9	10,4

Key:

1. Outlay group
2. Items of total estimate
3. Unforeseen outlays
4. Outlays on local facilities
5. Group's average proportion, %
6. Standard deviation, %
7. Group's minimum proportion, %
8. Group's maximum proportion, %

Inasmuch as the number of plans is insignificant ($n=23$), it is impossible to test the statistical hypotheses, for example on the normality of the distribution law for the proportion of item 2 with respect to the total cost using parameters $\bar{P}_2$ and $\sigma(P_2)$, since use of Pearson's χ^2 test requires not less than 50 observations. All that can be tested is the rule of the "three sigmas":

The range of values $P_2 = 46.8\text{-}65.6$ percent fits within the interval

$$\bar{P}_2 \pm 3\sigma(P_2) = 43{,}8 \div 72{,}8\%.$$

Testing for the presence of systematic changes in the proportion of item 2 with respect to total estimated cost in relation to time using the trend test produced a negative result.

A simplified method of determining estimated cost may be proposed in correspondence with the discussion above. Outlays making up item 2 are calculated using conventional planning techniques or with the assistance of enlarged cost indicators. Then the resulting outlay value is divided by the average proportion of this item,

$$S_m = S_2/0{,}583. \qquad (4)$$

The proposed method is characterized by a mean relative error (characterized by the coefficient of variation of the proportion of item 2) of 8.5 percent, while maximum error does not exceed 20 percent. In this case the results are more accurate than when using conventional methods for calculating approximate relative capital outlays on the basis of similar plans. Thus the estimated cost arrived at for mine 16/17 in the western Donets Basin (planned in 1979) was associated with an error of 17.4 percent when an analogue was used (mines 6/42 and 21/22 planned in 1976), while the error associated with the method proposed here was 2.2 percent.

Were we to directly calculate item 3 outlays as well, this would increase the accuracy of evaluating the estimated cost by 12 percent in comparison with direct calculation of just item 2, since $k_v(P_2+P_3)=7{,}5$ percent and $k_v(P_2)=8{,}5$ percent. It is also obvious that calculation of outlays separately from each group from 1 to 14 (when the outlays in item 2 are known) using relative proportions leads to a very large error. It follows from Table 1 that the coefficient of the variation exceeds 20 percent, and it can attain as much as 270 percent.

In planning practice, to arrive at approximate assessments of estimated cost we often calculate only items 1 to 7 in detail, and we determine the total of the remaining outlays as a percent ratio of the total of these items. The data in Table 1 permit assessment of the error of such a calculation method. In fact,

$$\sum_{i=1}^{7} \bar{P}_i = 79{,}9, \ \sigma\left(\sum_{i=1}^{7} P_i\right) = 3.82$$

and the coefficient of variation is $k_v=4{,}8$ percent--that is, the mean relative error in comparison with calculating just item 2 decreases by 44 percent.

The resulting mean proportions also permit assessment of the influence of the error of determining outlays within a given item of the estimate on the error of the total estimated cost. Thus for example, a 10 percent error in determining outlays in item 2 results in an error of the total estimated cost $10\bar{P}_2=5{,}83$ percent; the same error in item 7 produces an error of 0.06 percent. If the maximum error of determining estimated cost is 5 percent, then the maximum error in item 2 (given that the rest of the items are calculated without

Table 2

Job Designation	Relative Proportion of Outlays with Respect to all of Item 2, Percent	Permissible Error, Percent
Stripping the deposit	33.8	50
Preparing the mine area and the lines of the stope	41.0	40
Underground transport	8.7	200
Raising	1.3	1320
Haulage on the surface	0.8	2120
Freight handling and warehousing	1.3	1320
Assembly, disassembly, transportation and adjustment of tunneling equipment	2.5	685
Transport of rock brought up from the mine during construction	1.5	1130
Other	9.1	188
Total	100.0	

error) is $5/0.583 = 8.6$ percent, while that in item 7 is $5/0.006 = 833$ percent.

Presence of additional information on the structure of outlays in some item in relation to different types of jobs permits evaluation of the error of determining the outlays of each job in similar fashion. Table 2 shows the structure of item 2 in relation to different types of jobs and the maximum errors of determining the outlays on these jobs, on the condition that the error of determining total estimated cost of a mine does not exceed 10 percent.

Conclusions

1. The estimated cost of new mines can be determined approximately for the conditions of the flat and tilted seams of the Donets Basin in the early planning stages (the master plan for the sector's development, technical-economic substantiation of detailed prospecting, technical-economic substantiation of conditions) by calculating outlays in item 2 and using formula (4). This method has a mean relative error of 8.5 percent.

2. If under the same conditions we additionally determine the outlays in item 3 as well, this reduces the relative error of determining the estimated cost of the mine to 7.5 percent. By determining the total outlays in items 1 through 7 using direct planning calculations, we can reduce the mean relative error of determining the estimated cost of a mine to 5 percent.

3. The obtained assessments of possible error associated with calculating individual parts of the estimate are especially important in regard to developing approximate, simplified methods of determining outlays, since they permit us to determine the set of the most influential factors and to weed out factors of minor influence on the basis of the permissible error of determining total estimated cost.

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MORE EFFECTIVE COAL MINING POSSIBLE IN KARAGANDA BASIN

Moscow UGOL' in Russian No 6, Jun 84 pp 41-43

[Article by Candidate of Economic Sciences R. S. Karenov, Karaganda Polytechnical Institute: "Analysis of the Factors of Raising Coal Mining Effectiveness in the Karaganda Basin"]

[Text] Utilization of the reserves for improving the relationship between labor productivity and its capital-labor ratio has important significance to raising the effectiveness of the work coal mines.

For mines of the Karaganda Basin, the mean annual rate of growth has been 8.7 percent for fixed capital, 7.2 percent for the capital-labor ratio and 1.75 percent for labor productivity. Faster growth of fixed productive capital in comparison with the capital-labor ratio can be explained by the fact that in this period the number of workers employed in coal mining increased by 15,000, or by 46.4 percent. The capital-labor ratio grew faster than labor productivity, which is why the output-capital ratio declined by 76 percent (Table 1).

Table 1

(1) Год	Среднемесячная производительность труда рабочего по добыче (2)		Фондоотдача (5)		Фондовооруженность труда (7)	
	(3) т	(4) в % к 1955 г.	(6) т/1000 руб.	(4) в % к 1955 г.	(8) руб/чел	(4) в % к 1955 г.
1955	47,0	100,0	127,5	100,0	4 480	100,0
1960	52,6	111,9	84,1	66,0	7 612	169,9
1965	56,2	119,6	59,2	46,4	11 472	256,1
1970	66,3	141,1	48,6	38,1	16 352	365,0
1975	91,2	194,0	40,7	31,9	26 983	602,3
1980	81,3	173,0	34,2	26,8	28 524	636,7
1981	76,3	162,3	31,4	24,6	29 172	651,2
1982	74,7	158,9	30,6	24,0	29 207	651,9

Key:

1. Year
2. Mean monthly labor productivity of a mine worker
3. Tons
4. Percent of 1955
5. Output-capital ratio
6. Tons per 1,000 rubles
7. Capital-labor ratio
8. Rubles per person

If the output-capital ratio will exhibit a declining trend, as is now the case in the mines, to keep the economy's growth rate high we will have to raise labor productivity, which in turn depends on the capital-labor ratio.

Research by many authors established that the quantitative mutual relationship between labor productivity and the capital-labor ratio is described by the classical Cobb-Douglas production function

$$y=AK^{\alpha}L^{\beta},\ 0<\alpha<1, \qquad (1)$$

where Y--annual coal mining volume, thousands of tons; K--cost of fixed productive capital, thousands of rubles; L--number of workers employed in coal mining; A, β, α--parameters of the function (α--coefficient of elasticity of Y with respect to K; β--coefficient of elasticity of Y with respect to L); $\alpha+\beta=1$.

My analysis made use of a modernized production function in which $\alpha+\beta\neq1$.

When $\alpha+\beta>1$ the rate of growth of production volume is greater than the rate of growth of production factors, and when $\alpha+\beta<1$, the reverse is true. This function is unique in that it is based on the assumption of independence of the influence of production resources from the results of economic growth (it is based on homogeneity of production factors and absence of a mutual relationship between reproduction of labor resources and fixed productive capital). In its improved form the production function is a simple and relatively dependable instrument for analyzing and predicting development of the economy.

When we use parameter values obtained from statistics on mines of the Karaganda Basin covering 1955-1980, the function acquires the following form:

$$y=0,104K^{0.4683}L^{0.2608}. \qquad (2)$$

In accordance with expression (2), a 1 percent increase in investments into fixed productive capital promoted a 0.47 percent increase in coal extraction, while a 1 percent increase in manpower caused a 0.26 percent increase in coal mining extraction. Total elasticity $\alpha+\beta<1$ $(0.4683+0.2608=0.7291)$,--that is, growth of the set of production factors is faster than growth of production volume, and therefore we observe the action of a falling return per unit of the scale of production.

The increment in the volume of mined coal is determined to a significant degree by the increment in fixed capital, and to a lesser degree by the increment in manpower. The effectiveness of the influence of factor K is 1.8 times greater than that of factor L. The larger α is and the smaller β is, the greater is the significance of replacing live labor by materialized labor.

The production function permits us to analyze the interchangeability of different production factors, the limits of interchangeability and its role in economics. To determine interchangeability of factors K, L we can determine the derivative of the equation (the isoquantum), which characterizes different combinations of factors supporting a given product yield. To determine the

points of the isoquantum we need to solve the production function equation relative to one of the factors, conditionally assuming it to be a dependent variable.

Calculations show that in 1975 the basin's mines employed 39,100 persons, while according to calculations made using the production function 40,300 persons were required. This can be explained by activation of major reserves for intensifying production. In 1980, 44,600 persons were employed, while according to the calculations only 30,200 were required. This difference can be explained by the fact that during the 10th Five-Year Plan the mining conditions worsened in the basin: The depth of development increased to 70 m; the number of longwalls with hard-to-collapse roofing increased from 4 to 26; 96 percent of the mines were classified as supercategorical with respect to gas, while 89 percent were classified as dangerous or hazardous with respect to sudden ejections of coal and gas. Shortcomings were noted in the organization of labor and production: Losses of work time in individual shifts in stopes equipped with mechanized complexes were 24-26 percent for the association as a whole, while at some mines these losses attained 30 percent and more; idleness at working faces is 20-30 percent due to equipment failures; the coefficient of machine time of extracting machines (with respect to coal) fluctuates between 20 and 25 percent; mine tunneling equipment experienced down time because of poor organization of repairs and the absence of spare parts. Insufficient use of fixed productive capital was accompanied by an increase in the number of workers, especially in auxiliary and subsidiary jobs.

Deviation of the calculated value of fixed productive capital from the actual value can be explained by the same reason. Had the conditions of 1980 corresponded to the average for the period under analysis, the required volume of coal could have been extracted with fixed productive capital worth not 1,272,300,000 rubles but only 1,025,300,000 rubles.

The influence of the extensive and intensive components of growth in extraction volume was established by transforming and subsequently analyzing the function presented above.

Growth in fixed productive capital was responsible for 4.26 percent of the annual 4.6 percent increase in coal mining volume in the basin, while growth in the number of workers was responsible for 0.34 percent of the increase.

The theoretical mean annual rate of growth of coal extraction volume (4.6 percent) is the difference between extensive sources of growth, 6.31 percent (5.84 + 0.47), and the intensive sources of growth, -1.71 percent (1.58 + 0.13). The theoretical increment in extraction volume increased annually by 4.6 percent owing to extensive use of fixed productive capital by 5.84 percent and its intensive use by -1.58 percent, and as a result of extensive use of labor resources by 0.47 percent and their intensive use by -0.13 percent.

Analysis of the calculations presented above would show that the problem of intensifying production has not yet been solved in the basin.

Table 2

(1) Показатели	1970 г.	1975 г.	1980 г.	1981 г.	1982 г.
(2) Общее число действующих очистных забоев	186	153	144	136	140
(3) Число забоев, оснащенных механизированными комплексами	48	105	130	119	126
(4) Уровень добычи из комплексно-механизированных забоев на пластах, залегающих под углом до 35°, %	32,2	73,6	95,2	95,2	96,2
(5) Средняя по всем действующим очистным забоям суточная нагрузка на очистной забой, т	605	875	809	820	839
(6) Средняя суточная нагрузка на один комплексно-механизированный очистной забой, т	913	1057	865	885	895

Key:

1. Indicator
2. Total number of working faces in operation
3. Number of stopes equipped with mechanized complexes
4. Level of extraction from fully mechanized stopes at seams lying at an angle of up to 35°, %
5. Daily load on working face, averaged with respect to all working faces in operation, tons
6. Average daily load per fully mechanized working face

Growth in labor productivity is the principal gauge of intensification of production and use of manpower. Beginning in 1976, labor productivity declined at mines of the Karaganda Basin. This is explained primarily by exhaustion of the range of effective application of resources for fully mechanizing mineral extraction and other resources (remote and automated control, lumber substitutes and so on), and by a decline in the daily load per mine and per working face (in 1975-1982 these indicators decreased by 19.9 and 4.1 percent respectively). The main reason for the decrease in the daily load per working face and in the mine as a whole was the absence of resources for fully mechanizing work on thin seams in new coal regions and on seams bounded laterally by rock of below-average stability and unstable rock, and an increase in the number of stopes characterized by complex mining and geological conditions. This brought on a tendency for the intensity of mineral extraction to decline.

Conversion of all working faces to progressive, highly productive equipment with a narrow operating width has now been practically completed (Table 2). But in 1970-1982 the load on the fully mechanized working face dropped by 2 percent.

One of the reasons for the low daily load per stope is that many of the complexes being introduced are not working in conditions corresponding to their technical characteristics. Consequently intensification of coal production depends today on increasing the load on the working face. Series production of the more-effective mining complexes 1UKP, OKP-70, KM-30 and KMP-130, which will replace

those presently in use, will have important significance. We need to intensify preparatory mining operations by making wider use of 4PP-2 tunneling combines in mixed and pure stopes and GPK-V and GPK-N combines in sloped stopes, by outfitting the stopes with productive fans for local ventilation and with ventilation pipes of large diameter, and by further concentrating the preparatory mining operations.

The number of workers employed in other underground jobs increased noticeably (by 19.7 percent) in the basin's mines in 1970-1982. Reduction of the labor-intensiveness of this group of coal mining jobs will promote an increase in the daily load on the mines.

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STATUS OF COAL MINE CONTROL SYSTEMS UPDATED

Moscow UGOL' in Russian No 6, Jun 84 pp 43-46

[Article by candidates of technical sciences N. A. Shmatkov and V. P. Klubin, Donetsk Branch of the State Planning, Design and Scientific Research Institute for Automation of Operations in Coal Industry: "Status and Directions of Development of ASU TPs of Coal Mines"]

[Text] Efforts to create automated production process control systems (ASU TPs) for mines have been under way since 1967 with the objective of improving and raising the effectiveness of the sector's operational control system.

Most ASU TPs presently in existence (at more than 45 mines) include three subsystems primarily contained within the M-6000 master computer complex: accounting and control of the work of working faces (the AIST subsystem); accounting and control of the work of underground locomotive transportation (the ASTRA subsystem); accounting of the descent-ascent and working time of underground laborers (the SATURN subsystem). The ASU TPs also contain an operational dispatcher's control subsystem consisting of a complex of KOD-1M controlling devices.

These mine ASU TPs are characterized by the following features: the organizational and technological content of the tasks; the data mode employed in their operation; the insignificant number of subsystems; centralized data processing and display; mutually associated subsystem software.

These features of mine ASU TPs are the product of the level of coal mining technology thus far achieved and the degree of automation of the principal and auxiliary production processes, in which case control of these processes and fulfillment of a number of production operations mandatorily involve participation of mine personnel.

In this connection organizational and technological processes associated with work at working faces and shortwalls, and not individual production units, devices and complexes of equipment interacting directly with the master computer complex, will be the technological objects of control of the mine ASU TP today and in the immediate future. These processes include supplying labor, material and power resources and providing transportation, repair services and so on, which are controlled by an open cycle foreseeing automatic

fulfillment of data functions associated with collecting, transmitting, processing and displaying data by a complex of the system's technical resources, and development and implementation of control decisions by mine personnel.

The principal directions of development of mine ASU TPs in 1976-1980 were: improving the software of existing systems, and developing technical decisions associated with creating data collection back-ups for the case of failure of the master computer complex, and with expanding the functional content of the mine ASU TP.

Development and experimental of the ASU TP of the Mine imeni Gazeta SOTSIALISTICHESKIY DONBASS of the Donetskugol' Association has now been completed. According to the plan, its M-6000 master computer complex, supplemented by a number of devices including a second disk unit, is to perform additional functions in subsystems involved with labor resources accounting and with control of the working faces and underground locomotive transportation; it is also to have new subsystems to account for the volume and quality of mined coal, to organize provision of materials to the stopes, and control of the gas content of the air and ventilation.

The experience of creating and introducing ASU TPs at coal mines confirmed their positive influence on the technical-economic indicators of the mines: Implemenation of organizational measured based on data provided by the SATURN subsystem is making it possible to significantly improve the use of manpower; the use of information produced by the AIST and ASTRA subsystems is making it possible to increase productivity at the working faces by 1.5-2 percent.

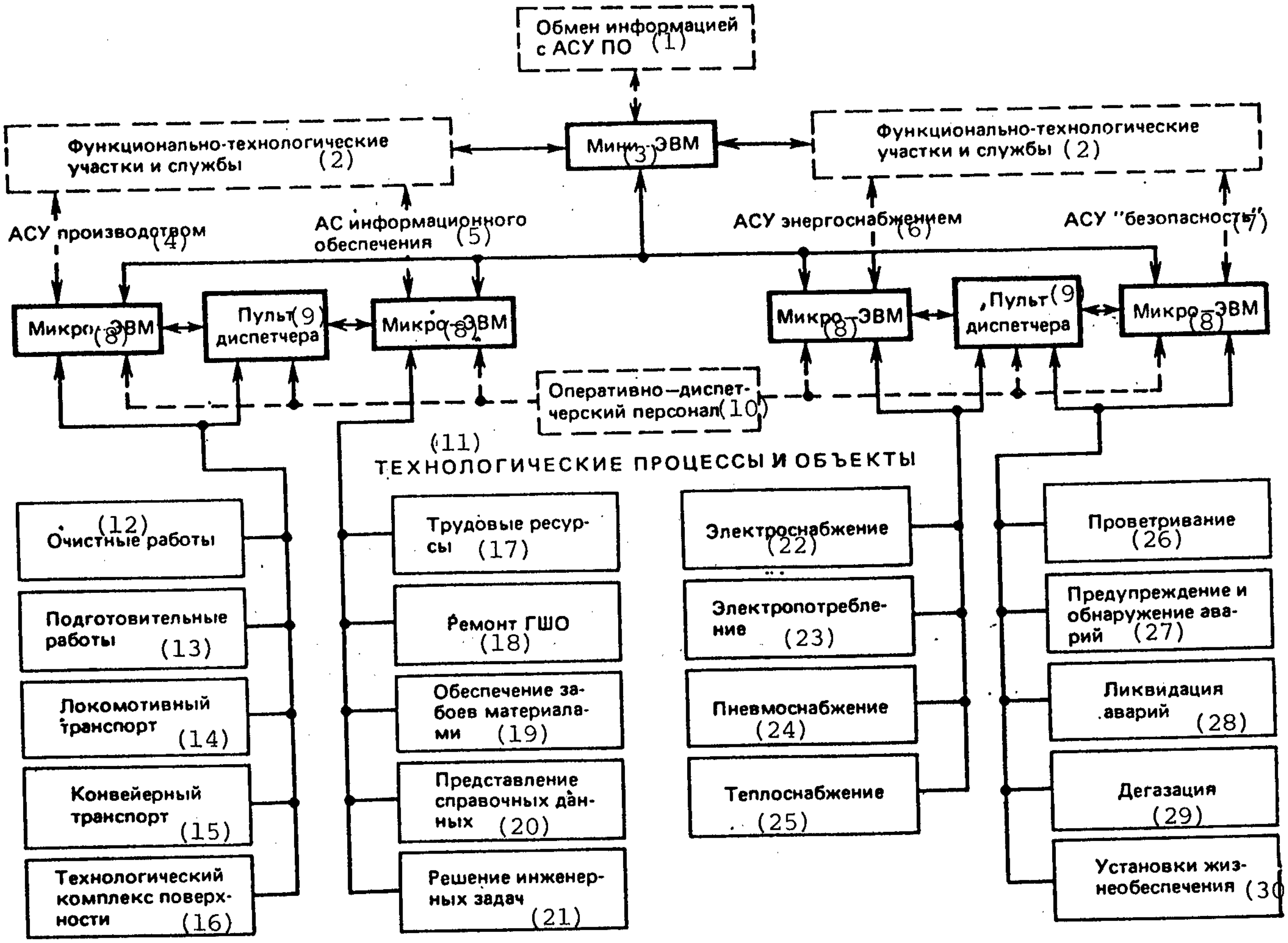
In addition to this, shortcomings have also been revealed in the adopted approach to building and implementing the ASU TP: insufficient reliability and viability of the system whenever devices of the M-6000 master computer complex, especially the disk unit, break down; the great laboriousness of writing and debugging the software; the significant complexity of software, which limits the use of subsystems involving a significant range of accountable parameters; absence of the possibility for increasing the number of tasks and subsystems.

The principal methodological premises that were used in creating the mine ASU TPs presently operating in the sector, and which are fundamental to their further development, call for integrated completion of the following tasks:

Conducting research to arrive at a quantitative assessment of production losses and shortcomings of the mine operational control system in order to determine the priority problems which, if solved by the ASU TP, would reduce these losses, eliminate the shortcomings and improve control of individual production processes of the mine as a whole;

formalizing the production problems in the form of mathematical economic models and algorithms, and determining the methods of solving these problems in the mine ASU TP;

creating new technical resources for data acquisition, transmission and display and for exercising control over production facilities under direct



Structural Diagram of a Mine ASU TP with Multilevel Data Processing Based on Micro- and Minicomputers

Key:

1. Data exchange with the production associations's automated control system
2. Functional-technological sections and services
3. Minicomputer
4. Automated production control system
5. Automated data support system
6. Automated power supply control system
7. Automated safety control system
8. Microcomputer
9. Dispatcher's console
10. Operational personnel and dispatchers
11. Production processes and installations
12. Mineral extraction
13. Preparatory operations
14. Locomotive transport
15. Conveyer transport
16. Surface production complex
17. Manpower
18. Mining equipment repair
19. Provision of materials to stopes
20. Display of reference data
21. Solution of engineering problems
22. Power supply
23. Power consumption
24. Air supply
25. Heat supply
26. Ventilation
27. Accident prevention and detection

[Key continued on following page]

28. Accident control
29. Gas decontamination
30. Life-support systems

control; selecting and substantiating the use of existing technical resources and computer technology to run the formalized problems and algorithms;

developing the planning documents for the mine ASU TP, to include special software for mathematical economic models and algorithms for the selected type of computer resources and for the functional and technical structures of the mine ASU TP under development;

developing and implementing organizational and technical measures associated with preparing the enterprise for work with the ASU TP or its individual subsystems, and with their introduction and their subsequent use and development.

The principal tasks are algorithmic or functional-structural synthesis of the ASU TP and its subsystems. A properly worded and formalized production task and the properly selected method of its completion predetermine the list of the initial parameters subject to accounting, monitoring, adjustment and control, and consequently the requirements on the corresponding data acquisition, transmission and display systems; they also predetermine the volume of other tasks and the effectiveness of the system.

When creating ASU TPs for coal mines, it would be suitable to examine the tasks of operational control of production processes in terms of time: shift (dispatcher's), daily, weekly and monthly. The existing mine ASU TPs perform the basic functions of completing certain tasks at the shift level of operational control. The following tasks have thus far been prepared for the ASU TP at this level of control: control of underground locomotive transport on the basis of data describing the cargo traffic from the working faces, the availability of empty cars at the loading points and the locations of the electric locomotives; control of mine ventilation depending on air consumption and gas release in the stopes; control of the cargo flow of conveyer lines and operational regulation of the ash content of delivered coal; monitoring production processes at working faces and shortwalls, and accounting for machine time and idleness of equipment; monitoring normal and safe working conditions, and detecting and preventing accident situations; monitoring consumption of electric and pneumatic power by mining operations and supply of such power to them, and others.

Not enough work has been done on problems associated with controlling the working conditions at the working faces and shortwalls in the presence of certain restrictions concerned with mining and geological disturbances, with the purpose of performing special preventive and production operations, with evolution of gas and ventilation and with limitations on energy and materials supply, problems associated with organizing repairs and damage control in the case of equipment failure and the action of certain mining factors, problems associated with determining availability and the ways of delivering required spare parts and materials and with prompt arrival of repair personnel in a place

experiencing an emergency situation, and problems associated with coordinating the efforts of all production units of the mine in the course of a shift.

At the daily level of operational control, preparations have been made to perform the tasks of determining the shift quotas for coal extraction depending on the technical and technological condition of the working faces and the manpower availability at the faces; providing materials to the working faces and shortwalls on a daily basis; drawing up orders for technical service and repair of extraction equipment for a repair shift.

The problems of coordinating the flow of coal, rock and materials and the delivery and issue of equipment (in the course of a day and shift), and of coordinating the tasks and work schedules of the principal and auxiliary sections and services of the mine have not been solved.

Tasks associated with drawing up weekly quotas and monthly schedules for planned preventive repairs on extraction equipment are being planned at the weekly and monthly levels of operational control. Problems still to be addressed include those of optimizing the weekly coal extraction volumes and conducting mining operations with a consideration for changes in the mining, geological and production conditions of these operations, problems associated with optimizing the weekly volume of preparatory operations in extraction areas with a consideration for the conditions of previous and forthcoming coal mining operations, and coordination problems concerned with monthly fulfillment of tunneling, assembly-disassembly, repair, damage control and special production operations associated with reinforcing and closing drifts and with special processing and preparation of seams (wetting, drying, decontaminating and so on).

The principal directions for development of mine ASU TPs include: modernizing and improving existing mine ASU TPs; creating mine ASU TP subsystems at the information and advisory level, integrated with higher levels of control; creating a new type of ASU TP permitting distributed data processing and realization of each subsystem or a number of associated subsystems using a separate microcomputer providing for independent data input from the appropriate sensors and devices.

The "Working Faces," "Shortwalls," "Underground Transport" (rail or conveyer), "Coal Haulage," "Ventilation," "Work Safety," "Manpower," "Mining Equipment Repair," "Provision of Materials to Stopes," "Power Supply" and "Operational and Dispatcher's Control" subsystems will be added successively to the mine ASU TP.

Work concerned with the first two directions will be done in 1983-1985 with the objective of expanding the functions of the AIST, ASTRA and SATURN subsystems and introducing new technical concepts into the subsystems "Extraction," "Materials" and "Mining Equipment Repair," made possible by the presence of improved software accounting for positive improvements in and proposals on a number of existing mine ASU TPs (at Velikomostovskaya Mine No 8 of the Ukrzapadugol' Association, Vorgashorskaya Mine of the Vorkutaugol' Association and the Pervomayskaya Mine of the Severokuzbassugol' Association) and

possessing better dependability characteristics and possibilities for introducing more tasks and subsystems.

With this objective in mind, technical resources that have worked their useful life will be replaced by improved resources, production of which has been assimilated (or is presently being assimilated) by plants of the Soyuzugleavtomatika All-Union Production Association.

Such technical resources include: the ITSK-2 remote control system; a complex of resources for collecting and transmitting data on the work of coal mining combines and dispersed installations (replacing the PPT-1 subsystem with its DPK-1 and DR-2 sensors); a device forming information with which to account for loaded and empty UFI cars equipped with an IRP loading station work indicator; the KURS coded trip information device; the ISU reader to keep track of laborers on the mine surface; the URSI data acquisition back-up device.

As existing and new ASU TPs are developed and improved, the technical concepts developed with the ASU TP of the Mine imeni Gazeta SOTSIALISTICHESKIY DONBASS will be introduced in their entirety into the ASU TPs; this will require addition of a number of devices to the M-6000 master computer complex, including a second disk unit.

Four relatively independent groups of automated control systems can be placed within the composition of the new type of ASU TP. Multilevel distributed data processing based on micro- and minicomputers is the basis for organizing ASU TPs of this structure.

The structure of a mine ASU TP with multilevel distributed data processing based on mircro- and minicomputers is shown in the figure.

Each of the groups of automated control systems will have a functional name: the production ASU [automated control system], the power supply ASU, the safe working conditions ASU and the automated system of data support to production.

The production ASU will concern itself with the production processes associated with extraction, transportation and unloading of coal and with preparatory operations; the power supply ASU will be concerned with electric and pneumatic power supply; the safe working conditions ASU will be concerned with the mine atmosphere, air circulation, decontamination, life support systems and the prevention, detection and elimination of emergency situations and accidents; the automated data support system will be concerned with manpower, repair of mining equipment, provision of materials to the stopes, provision of information and reference data to mine surfaces and executives, and solution of engineering problems.

These groups of automated control systems and the individual subsystems will basically operate at the information and advisory level, and they will perform the functions of insuring compatibility with higher levels of control. They can take the form of individual microcomputers, and they can be used independently and in different combinations. This makes it possible to employ them at most mines with a consideration for economic effectiveness.

In large mines and mine administrations in which use of the entire set of subsystems and groups of automated control systems is possible, the tasks of automated data support, of the processing of data coming in from microcomputers and of maintaining compatibility with the association's ASU will be carried out by a central minicomputer at the second level of data processing at the mine.

SM-1800 or SM-1634 microcomputers and SM-4 or SM-2M minicomputers are to be used as the technical resources for data processing and display.

The principal directions in the long-range development of technical data collection, transmission and processing resources will be:

creation of integrated remote control resources specialized in relation to the particular facilities and parameters to be monitored (dispersed facilities, permanently installed facilities, underground transport facilities, equipment to monitor mine atmosphere parameters and so on) and providing for transmission of signals by the mine's power supply network from these mine facilities to the surface, for transmission of signals on free pairs of conductors and for the supply of power to underground blocks of apparatus and the appropriate sensors from the surface;

creation of new sensors and data acquisition devices with higher operating characteristics, designed on the basis of contactless principles of operation, current sensors with which to monitor the "on" state of mechanisms that can be installed on cable lines without stripping the latter, polyfunctional sensors for monitoring the work of coal mining combines, and manual data input devices;

data display in the control room and in production sections using modular computer resources equipped with color graphic and alphanumeric video terminals (the RMOT-01 operator's work station, the TSO-5 facility communication terminal and others), and specialized resources for displaying graphical and numerical data permitting reflection of the basic production indicators and work results at the current moment and at the end of work shifts and days;

wide use of computers equipped with functional keyboards permitting data input by operational personnel of the mine services from their work stations.

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EFFECTIVENESS OF COAL MINE CONTROL SYSTEMS ANALYZED

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[Article by Candidate of Technical Sciences N. M. Yakunov, VNIIUugol' (not further identified): "Economic Effectiveness of Automated Control Systems"]

[Text] The sizable material, human and financial resources involved in the creation and operation of automated control systems elicit the need for improving them and raising their effectiveness.

The effectiveness of introducing computer technology is reflected in the planning and accounting indicators of the production and business activities of associations and enterprises. Introduction of computer capacities, capital investments, introduction of automated control systems and information and computer centers at individual facilities, the savings from introducing computer technology and other indicators are planned at the level of the USSR Ministry of Coal Industry. The savings indicator is reflected in the plans for coal extraction cost in relation to each production association, with regard for capital outlays and the standard coefficient of the effectiveness of computer technology.

The principal indicators used in calculating the economic effectiveness of automated control systems are the outlays on creating, introducing and assimilating automated control systems, the operational expenditures on their maintenance and the savings from their introduction, while the annual economic impact, the coefficient of effectiveness and the time of compensation of outlays are secondary indicators.

Economic impact is measured in financial terms as the increment in total profit resulting from growth in the production volume and product sales volume, and the increment of the savings from reducing product cost.

Reduction of product cost in relation to different expense items is determined by the following indicators:

reduction of conditionally constant expenditures owing to an increase in production volume resulting from concentration and intensification of production, maximum use of equipment, maintenance of production rhythm and optimum planning of the work of enterprises, sections, shops and services;

the relative savings in the wage fund for the principal production workers owing to a labor productivity growth rate that is higher than the rate of growth of average wages and the absolute savings in the wage fund of administrative workers released for other work in connection with redistribution of control functions and automation of administrative labor;

reduction of expenditures on materials as a result of a decrease of their unit expenditure, optimization of expenditure norms, optimization of equipment repair plans and selection of efficient production flows;

reduction of depreciation deductions as a result of improvements in the use of fixed capital;

the savings from reducing unproductive outlays (losses due to waste, fines, penalties, unstable operation, overtime pay and down time) resulting from better organization of labor, acceleration of document turnover, fulfillment of production plans and delivery of products in their required assortment and by the required deadlines.

Economic effectiveness is determined from the annual increment in profit (savings) resulting from operation of the automated control system, from the annual economic impact and from the effectiveness of outlays on the system's creation. The annual increment in profit (or the savings) is calculated using the formula

$$Э^{A}_{year}=\left(\frac{A_2-A_1}{A_1}\right)\times$$
$$\times\,П_1+\left(\frac{C_1-C_2}{100}\right)A_2,$$

where A_1 and A_2--annual product sales volume in wholesale prices before and after introduction of the automated control system, thousands of rubles; C_1 and C_2--outlays per ruble of sold products before and after introduction of the automated control system, kopecks; $П_1$--profit from product sales prior to introduction of the automated control system, thousands of rubles; $\left(\frac{A_2-A_1}{A_1}\right)П_1$ --annual profit increment resulting from an increase in product sales volume, thousands of rubles; $\left(\frac{C_1-C_2}{100}\right)A_2$ --annual cost savings resulting from reduction of production outlays, thousands of rubles.

Nonproductive losses that are not included in product cost and which are additionally accounted for in the annual savings decrease in the presence of an operating automated control system as a result of control over prompt fulfillment of business contracts, payment of suppliers and receipt of payments from consumers by the established deadlines, and operational regulation of other financial relationships of the enterprises or associations.

If the automated control systems of production associations (enterprises) perform tasks for other organizations of the sector which are not within the composition of the association (mine construction, machine building, trade and other organizations), then the savings from completing these tasks are additionally accounted for in the total annual savings.

Annual economic impact is determined using the formula

$$Э_{к.в} = \left(\frac{A_2 - A_1}{A_1}\right) П_1 + \left(\frac{C_1 - C_2}{100}\right) \times$$
$$\times A_2 + Э^A_ф + Э^A_{др} - E_н K^A_д,$$

where $E_н$ --standard coefficient of economic effectiveness of capital investments, $E_н = 0{,}15$; $K^A_д$ --outlays on creating and introducing the automated control system, thousands of rubles.

The annual economic impact reflects the economic effectiveness of the automated control system with a consideration for the outlays on its creation. In this case the effectiveness of the outlays is determined using the formulas

$$E_p = \frac{Э^A_{year}}{K^A_д} E_{нвт};$$

$$T = \frac{K^A_д}{Э^A_{year}},$$

where E_p--calculated coefficient of the effectiveness of outlays on creating the automated control system; T--time required to compensate for the outlays, years; $E_{нвт}$--established standard coefficient of effectiveness of computer technology for the sector.

Of the total volume of capital investments (Table 1), 8.1 percent were spent on creating automated control systems, introducing computer technology and developing the existing sector automated control system of the USSR Ministry of Coal Industry, 70.4 percent were spent to create new automated control systems for production associations, machine building enterprises and the computer centers of scientific research and planning organizations and on developing existing ones, and 21.5 percent were spent on creating automated production process control systems for mines and open pits.

The total capital investments include outlays on introducing new systems, developing existing ones and replacing obsolete computer equipment. Equipment outlays represent 78.4 percent of the structure of capital outlays, while construction and installation associated with construction and repair of information and computer center buildings and communication lines and with organizing information stations at the enterprises represent 15.6 percent of the outlays. Of the total equipment outlays, 65 percent represent the cost of computers.

Depending on the equipment available at information and computer centers, on the number of information stations contained in automated control systems and on the need for rebuilding communication lines, the outlays on creating an automated control system for a production association are 1-4 million rubles (an average of 2.2 million rubles for the sector). About 15 percent of the total capital investments into computer technology are spent on planning automated control systems of different levels and on developing the software.

Table 1

(1) Структура затрат	1965—1970 гг.	1971—1975 гг.	1976—1980 гг.
(2) Создание ОАСУ Минуглепрома СССР	—	8,1	8,1
(3) Создание и развитие ИВЦ и АСУ в производственных объединениях, развитие действующих ВЦ НИИ и проектных институтов	79,5	55,5	70,4
(4) Создание АСУТП на шахтах и разрезах	20,5	36,4	21,5
(5) Всего	100	100	100
(6) В том числе:			
(7) строительно-монтажные работы	28,9	14,7	15,6
(8) приобретение оборудования	62,7	81,3	78,4
(9) прочие	8,4	4,0	6,0

Key:

1. Structure of outlays
2. Creation of the USSR Ministry of Coal Industry's sector automated control system
3. Creation and development of information and computer centers and automated control systems in production associations, and development of existing computer centers of scientific research and planning institutes
4. Creation of automated production process control systems at mines and open pits
5. Total
6. To include
7. Construction and installation
8. Equipment acquisition
9. Other

The 11th Five-Year Plan foresees spending 25.4 million rubles annually to develop automated control systems and introduce computer technology. This is almost 40 percent more than was spent in the 10th Five-Year Plan. Outlays on peripheral equipment and on data retrieval and display resources will grow significantly in this case.

The relative weight of the cost of data processing equipment in relation to the total cost of fixed capital is an indicator characterizing the level of automation of control. In practice this indicator differs significantly from

its average. Thus the proportion of data processing equipment with respect to the total cost of fixed capital in the Intaugol' Association is 1.38 percent, and for the Kemerovougol' Association it is 0.18 percent, while the sector average is 0.45 percent.

The principal indicator characterizing the economic effectiveness of introducing automated control systems is the savings or profit increase obtained as the result of the system's operation. The actually attained savings is calculated using the sector's methods for determining the economic effectiveness of the automated control systems of production associations, enterprises and organizations.

The total savings from creating and developing all levels of automated control systems and of introducing computer technology into scientific research and planning was 47.2 million rubles per year, while the savings from creating the automated control systems of production associations was 25.1 million rubles. In this case the coefficient of effectiveness of capital outlays was 0.39. Of the total savings resulting from introducing automated control systems into production associations, 13.2 million rubles or 53 percent was due to a decrease in product cost. Economic impact accounting for capital outlays was 15.1 million rubles. Table 2 shows the actual economic effectiveness of automated control systems introduced into production associations.

The planned effectiveness indicators have been achieved for the absolute majority of operating automated control systems, while the coefficient of effectiveness of capital investments exceeds the standard. But at the same time certain automated control systems have not reached their planned effectiveness indicators. Economic impact has dropped somewhat, on one hand because of the higher cost of third-generation computers, and on the other hand due to their unsatisfactory use in a humber of associations.

An analysis of planned and actual effectiveness indicators established that in terms of the standard set of tasks carried out by each subsystem, the savings from introducing an automated control system depends primarily on production volume and production cost in each production association. Therefore the amount of computer equipment supplied to an information and computer center must be determined with regard for extraction volume, number of enterprises, number of laborers and administrative workers and the cost of fixed capital. In addition a certain mutual relationship has been established between these indicators and the principal indicators of the effectiveness of automated control systems: equipment availability, capital outlays, operating expenses and the attained savings. But at the same time the amount of equipment possessed by a number of information computer centers, as related to the production and economic indicators of the association's activities, is far from identical (Table 3). Thus the proportion of workers employed by information and computer centers with respect to the total number of workers is 0.34-2 percent, the proportionate outlays for computer equipment per laborer are 14-236 rubles, the proportionate outlays on computer equipment per administrative worker are 119-1,557 rubles, and the proportionate computer support is 9-123 operations per second.

Table 2

Associations with Automated Control Systems	(1) Год ввода	(2) Годовая экономия, тыс. руб.		(5) Годовой экономический эффект, тыс. руб.	(6) Коэффициент эффективности затрат на создание АСУ	(7) Среднесписочная численность работников ВЦ	(8) Среднегодовая стоимость основных фондов по обработке информации, тыс. руб.
		(3) всего	(4) в том числе по себестоимости				
Vorkutaugol'	1974	1555	1500	990	0,41	335	3442
Vostsibugol'	1977	523	261	239	0,27	89	765
Karagandaugol'	1968	2554	1250	1907	0,59	414	7333
Novomoskovskugol'	1974	845	423	572	0,46	189	2444
Prokop'yevskugol'	1975	409	205	260	0,41	231	2590
Rostovugol'	1974	756	378	240	0,22	359	2535
Ekibastuzugol'	1978	839	420	590	0,51	106	1156
Estonslanets	1979	773	386	559	0,54	142	1430
Yuzhkuzbassugol'	1975	931	466	430	0,28	170	2650
Artemugol'	1973	968	484	598	0,39	326	2384
Donbassantratsit	1974	1042	521	635	0,38	329	2701
Donetskugol'	1973	695	348	105	0,21	380	3266
Krasnoarmeyskugol'	1975	754	377	430	0,34	303	2011
Pervomayskugol'	1975	257	378	497	0,34	234	1543
Torezantratsit	1973	981	490	514	0,32	274	3112
Ukrzapadugol'	1974	721	360	411	0,34	269	2756
Average		865	456	522	0,39	236	2262

Key:

1. Year of introduction
2. Annual savings, 1,000 rubles
3. Total
4. Including in relation to product cost
5. Annual economic impact, 1,000 rubles
6. Coefficient of effectiveness of outlays on creating automated control systems
7. Average official number of computer center workers
8. Mean annual cost of data processing equipment, 1,000 rubles

Proportionate indicators vary by more than tenfold in different automated control systems. This can be explained by differences in the time it takes to achieve the operating capacity of computers, by shortcomings in the planning of the distribution of computer equipment and by the absence of adequate standards.

The principal directions of raising the effectiveness of automated control systems in the 11th Five-Year Plan are:

completing creation of automated control systems in all coal mining production associations;

Table 3

Association	Удельная экономия стоимости валовой продукции, % (1)	Удельный вес работников ИВЦ в общей численности трудящихся, % (2)	Удельная стоимость основных фондов по переработке информации к общей стоимости фондов, % (3)	(4) Удельные затраты по ВТ, руб.		(7) Удельная вооруженность, операций в секунду	
				на трудящегося (5)	на АУП (6)	на одного трудящегося (5)	одного АУП (6)
Vorkutaugol'	0,45	1,01	0,39	114	752	6,2	41,1
Vostsibugol'	0,10	0,49	0,28	106	690	2,2	14,8
Karagandaugol'	0,34	0,60	0,49	63	435	3,7	25,6
Novomoskovskugol'	0,57	0,66	0,83	64	484	4,2	31,8
Prokop'yevskugol'	0,10	0,34	0,35	14	149	2,9	9,3
Rostovugol'	0,17	0,49	0,32	46	496	4,0	43,5
Ekibastuzugol'	1,20	1,18	0,30	184	837	17,3	81,4
Estonslanets	0,65	0,99	0,65	100	698	11,2	78,0
Yuzhkuzbassugol'	0,16	0,39	0,45	77	575	4,6	34,4
Primorskugol'	0,14	0,39	0,45	77	575	4,6	34,4
Artemugol'	0,71	0,60	0,25	46	461	4,1	41,2
Donbassantratsit	0,79	1,38	0,36	114	1140	9,2	90,4
Donetskugol'	0,26	0,46	0,19	39	390	2,7	27,4
Krasnoarmeyskugol'	0,73	1,48	0,36	105	1051	9,8	98,0
Pervomayskugol'	0,65	0,72	0,27	67	673	6,0	60,4
Stakhanovugol'	0,84	0,62	0,29	50	510	2,7	27,4
Torezantratsit	0,44	0,73	0,44	88	889	5,7	57,0
Ukrzapadugol'	0,30	0,73	0,52	56	581	5,4	54,2
Sector average	0,52	0,84	0,45	75	753	5,8	58,0

Key:

1. Relative savings of gross product cost, percent
2. Proportion of information and computer center workers with respect to total number of laborers, percent
3. Ratio of cost of data processing equipment to total cost of fixed capital, %
4. Proportionate outlays for computer technology, rubles
5. Per worker
6. Per administrative worker
7. Proportionate support, operations per second

developing and introducing standard sector economic, mathematical and software systems to support analysis of production and business activities and optimum planning;

introducing a unified data support system based on an integrated data base concerned with specific areas and servicing all levels of control from the enterprise to the ministry;

finishing transfer of developed tasks from the Minsk-32 computer to the YeS computer;

having problem developers and remote terminal users make wide use of computers for work in interactive mode;

raising the level of standardization of tasks and expansion of the areas of their application;

finishing automation of accounting and control functions at all levels of control;

improving the planning, distribution and use of computer equipment on the basis of a system of substantiated standards;

raising the average daily load on YeS computers and the efficiency of the use of computer time to solve industrial problems;

creating, out of existing information and computer centers, time-sharing computer centers that can additionally serve users in mine building, machine building, transportation and other sector enterprises and organizations.

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EFFORTS TO IMPROVE WORKING CONDITIONS IN OPEN PITS UNDER WAY

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[Article by Engineer Yu. V. Pchelkin, NIIOGR: "Methods and Resources for Improving Working Conditions at Open Pits"]

[Text] Improving working conditions is one of the most important tasks in the program of social transformations now being implemented in the USSR. This task is especially important in coal industry.

Despite the fact that working conditions at open pits are significantly better than in mines, the injury rate is still high in open pit operations. This is why the NIIOGR [not further identified] is devoting considerable attention to developing and introducing effective methods and resources for improving working conditions in open pits.

Since 1974 the institute has conducted yearly analyses of the status and causes of job-related injuries at open pits, and it has been drawing up recommendations for injury prevention on the basis of these analyses. The analysis data show that between 1966 and 1980 the injury rate in open pits decreased by 39 percent, while the frequency of severe injuries decreased by 37.5 percent.

According to an analysis of the causes of job-related injuries occurring in 1976-1980, the number of accidents (percent) resulting from violation of the safety regulations and instructions on labor protection is 39.2, to include a percentage of 26.2 for violations made by the victims themselves; unsatisfactory labor organization--18.1; lack of caution by the victims--17.5; improper work procedures--10.7; machinery and equipment failure--3.2; design shortcomings of machinery and equipment--1.9; inadequate mechanization and automation of production processes--1.4; other causes--8.

It follows from the results of the analysis that most accidents (67.4 percent) occurred due to violation of the safety regulations and instructions on labor protection, due to the victim's lack of caution and due to improper work procedures. Many accidents occur because of unsatisfactory organization of labor. In this connection the institute is doing a great deal of work to create the necessary standards and methodological documents, and resources by which to publicize industrial safety at open pits.

Thus standard instructions on labor protection were written up for workers in 64 occupations. Six motion pictures on job safety associated with the principal production processes of open pit coal mining were released.

An analysis of the distribution of accidents with respect to different production processes in 1976-80 showed that the quantity of accidents (percent) associated with repair and installation of machinery and equipment is 22.1; loading, unloading and moving loads--14.1; operating motor vehicles and tractors--7.4; excavator operations--5.4; work at machine tools and woodworking tools--3.9; operation of rolling stock--2.9; servicing power production installations--2.6; drilling operations--2.4; transportation of workers in the open pit--17.4, to include pedestrian travel--13.5; other--11.8.

It follows from the analysis of injuries with respect to production processes that the greatest number of injuries occur not in the principal production processes but during repair and installation of machinery and equipment and during the loading, unloading and moving of loads; the injury rate associated with transportation of workers in the open pit, and especially on foot, is high.

The largest proportion of injuries is caused by falling objects and cave-ins (20.9 percent), during transportation and hauling of equipment (18.5 percent), by falls (17.5 percent) and by work with machines, mechanisms and equipment (11.6 percent).

As the depth of mining operations in open pits increases, natural air exchange worsens significantly, as a result of which toxic impurities accumulate in high concentrations, sometimes exceeding the permissible public health norms. Eleven open pits are now over 150 m deep. In the next few years their number will increase to 20, and in the future the depth of open pit mining will attain 550 m.

Conditions become especially bad in winter as a consequence of temperature inversions accompanying advection of heat on the ground adjacent to the open pit. Accumulation of toxic impurities at this time promotes formation of smog and fog. In a number of cases this phenomenon makes cessation of work and removal of personnel from the open pit necessary.

Research conducted by the NIIOGR established that gas contamination of open pits occurs primarily owing to entry of carbon monoxide from endogenous fires, and owing to low temperature oxidation of coal and carbonaceous inclusions, especially when they undergo spontaneous heating to 75°C. An increase in temperature from 25 to 75°C causes an increase in formation of low-temperature carbon monoxide by a factor of 16-30; a large surface area of exposed coal, as seen for example in the Korkinskiy open pit, for which this area is about 160 hectares, promotes entry of this carbon monoxide into the open pit's atmosphere.

When motor transportation is operated in open pits, their atmosphere becomes intensively contaminated by aldehydes, carbon monoxide, nitric oxides, carbon dioxide and sulfur dioxide. Moreover when 1 ton of diesel fuel is burned in

engines, 1.3 tons of moisture are released into the atmosphere; in the presence of low winter temperatures this moisture is an intensive source of fog.

Complex air exchange conditions are anticipated at the Neryungrinskiy open pit, where even though the weather conditions are extremely unfavorable (intense frosts, prolonged periods of no wind, frequent inversions), the plan foresees simultaneous operation of 100-120 dump trucks with capacities of 120-180 tons; the total daily consumption of diesel fuel is 250-300 tons, and the daily expenditure of explosives is 150-300 tons.

Presence of large quantities of air in open pits elicits the need for creating powerful ventilation systems. The existing devices (UMP-1, PVU-6 and others) are capable of only local airing of individual stagnant zones.

The NIIOGR, the VNIIGM imeni M. M. Fedorov and the Dnepropetrovsk affiliate of the VNIPIrudmash [not further identified] have developed the technical assignment and completed the draft project for a new high-power fan, the UV-1, which is intended for general ventilation at open pits. The device will produce a high ventilation flow (up to 1,920 m^3/sec at the device outlet), and the range of the flow will be high (up to 1,400 m). Given an insignificant increase in fuel consumption (10 percent) in comparison with the base model, the NK-12KV, the new device will create a ventilation flow that is 2.1 times greater at the device's outlet, the range of flow will increase somewhat (by 6 percent), and the mobility of the device will increase significantly.

UMP-1, UMP-14 and UMP-21 self-propelled local ventilating systems will be needed at the open pits of the Yakutsk ASSR and Siberia concurrently with fans providing for general ventilation.

Endogenous fires are not only the principal source of toxic impurities released into the atmosphere of open pits, but they also cause large losses of exposed coal reserves prepared for extraction and elicit significant outlays of manpower and material resources associated with putting the fires out and repairing the damage.

Jointly with the Moscow Institute of Chemical Technology imeni D. I. Mendeleyev, the NIIOGR completed a complex of studies on spontaneous combustion of coal being mined by the open pit method at a number of deposits of the Southern Urals and West and East Siberia. The principal factors affecting the fire danger in open pits were established, and methods and resources for controlling spontaneous combustion were developed.

Occurrence of endogenous fires in an open pit depends in many ways on how well the mining procedures correspond to the mining and geological conditions and to the source of the coal. Among the large numbers of technical factors that play a dominant role in spontaneous combustion of coal in the majority of cases, we should single out the rate at which the work front moves forward, the periodicity with which coal benches are renewed and the completeness of their removal, and the type of mining equipment employed. In this connection all technical parameters (bench height, length of work front and so on) used in determining the specifications of open pits from which coal prone to spontaneous

combustion is to be extracted must be adopted with a consideration for their influence on spontaneous combustion of coal. Compliance with procedural discipline when conducting mining, drilling and blasting operations (completely removing all material loosened by the blast, carefully cleaning off all elements of a bench and so on) also has no less important significance.

Antipyrogens have recently been enjoying extensive application in open pits. The NIIOGR has developed a method of preventing endogenous fires based on using neutralized black contact substance (NChK)--a petroleum refining product. NChK was successfully tested and recommended for industrial use at the Korkinskiy and imeni 50-Letiye Oktyabrya open pits. But this antipyrogen does have its shortcomings: it is readily washed away by precipitation, and its antipyrogenic properties are insufficient in relation to coal characterized by high moisture content and porosity. A new antipyrogen was developed out of NChK consisting of NChK and 5 percent added calcium chloride; a method of preventing and extinguishing endogenous fires based on separate application of the ingredients of the antipyrogen was also developed. But because of the corrosive action of calcium chloride on metals and the significant costs of its transportation over great distances, it has been difficult to introduce this anitpyrogen on a major scale. Laboratory studies are now being conducted on a number of petroleum products possessing better antipyrogenic properties then NChK and exhibiting none of its shortcomings.

Industrial experiments are being conducted at the Kharanorskiy open pit with an antipyrogen consisting of two ingredients--water glass and borax. When this antipyrogen is used to put out fires, the high temperature causes formation of a heat-resistant film that covers the surface of the object and keeps air out.

A new direction has recently appeared in the fight against spontaneous heating and spontaneous combustion of coal, based on growth in the intensity of electric fields in spontaneously heating coal accumulations. The possibilities of this direction are being subjected to experimental testing at the Kharanorskiy open pit.

The results of these studies were used by the NIIOGR as the basis for writing an interim manual on preventing and extinguishing endogenous fires at open pits.

Dust is created in open pits by all of the principal production processes at a rate of tens and hundreds of mg/m^3. The dust content of air is greatest around rotary excavators removing coal and around moving motor transportation.

The NIIOGR, the Mining Institute imeni A. A. Skochinskiy, the UkrNIIproyekt [not further identified], the Eastern Scientific Research Institute of Work Safety in Mining and the Novokromatorskiy Machine Building Plant Association developed the technical assignment for a dust trapping system intended for the high-productivity ERShRD-5000 rotary complex, which operates on the basis of high-pressure hydraulic irrigation and aspiration.

The dust binding substance universin and the SPA self-propelled sprinkling unit were developed to keep dust down on motor roads in summer, and they are now in series production. The SPA is mounted on a BelAZ-504A truck chassis, and it is equipped with a 25 m^3 tank, a nozzle-equipped spreading reservoir, two TsV-6.3/160 pumps, slotted sprinklers and a multibladed ripper.

Interim instructions on the use of the dust binding substance universin to control dust on motor roads in open pits were written by the NIIOGR with the objective of achieving wide introduction of universin at open pits.

In order to achieve control of dust on motor roads at negative temperatures, the NIIOGR has developed a technical assignment for the dust binding substance "Universin-S" jointly with the Ufa Petroleum Institute. An experimental lot of this substance was tested at the Neryungrinskiy open pit of the Yakutugol' Association, where it demonstrated good results.

Introduction of the described methods and resources of improving working conditions into the open pits will promote prevention of job-related injuries, reduction of morbidity among laborers and an increase in productivity of mining and transport equipment.

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METHANOL-WATER MIXTURE FOUND BEST FOR COAL SLURRY USE

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 7, Jul 84 pp 16-17

[Article by Yu. G. Svitlyy, T. V. Karlina and V. F. Krut', All-Union Scientific Research and Project Design Institute of Hydraulic Pipelines; K. A. Belov and S. A. Ustinovskaya, Kharkov Polytechnical Institute: "Selecting a Carrier Fluid for Coal Slurry Pipelines"]

[Text] In recent years, the hydraulic transport of coal in main slurry pipelines has attracted much attention. Most of these systems use water as the carrier fluid. Experience has shown, however, that this causes a difficult problem when the coal is dewatered after delivery. Water cleaning after filtering is a complicated process, though it is necessary in order to use the water in the return cycle or to discharge it from the receiver's facility. The use of other carrier fluids, such as liquified carbon dioxide or alcohols (methanol and ethanol), and crude oil is possible. CO_2 is easy to separate from the coal, while the others add to the total calorific value of the coal. The separated carrier fluid can always be used by the receiver. This prevents unrecoverable energy losses in transporting water.

Of the aforementioned carrier fluids, methanol is the most promising for coal slurry pipelines.

Coal always contains a certain amount of moisture after it is ground up in preparation for pipeline transport. Therefore, pure methanol-coal mixtures are practically non-existent.

At identical temperatures, water is 1.7 times more viscous than methanol and 1.3 times denser.

The viscosity characteristics of water-methanol mixtures are given in Table 1. They were obtained on a VPZh-2 viscosimeter with a capillary diameter of 0.56 mm.

As the methanol content increases, the mixture's viscosity changes along the curve until reaching a maximum at 40 percent water and 60 percent methanol ($\eta = 1.74 \cdot 10^{-3}$ Pa·sec).

Table 1. Viscosity as a Function of Methanol (CH_3OH) Concentration in Water

CH_3OH Concentration in a Water-Alcohol Solution, volume % at 20° C	Viscosity of the Water-Methanol Solution, 10^{-3} Pa·sec
0	0.984
20	1.53
40	1.74
50	1.68
60	1.59
80	1.18
100	0.58

Table 2. Viscosity of the Coal Slurry Mixture as a Function of Its Liquid Phase Content

Slurry Mixture Content, %			Elapsed Time t, sec	Dynamic Viscosity, $\eta \cdot 10^{-3}$ Pa·sec
Coal	Water	Methanol		
50	-	50	65	0.278
50	35	15	88	0.433
50	25	25	57	0.265
50	50	-	59	0.287

Grades "D" and "G" coal from the Inskaya Mine, pulverised to less than 1 mm were used for viscosity research in water-methanol mixtures. The coal had an ash content of 13.28 percent. Equal volumes of the solid and liquid phases were used. Water, methanol, and water-methanol mixtures were used as the liquid phase. Since no suitable viscosimeters were available for such slurry mixtures, a 150-milliliter funnel with an outlet diameter of 3 mm was used for the tests. Test results are given in Table 2.

A comparison of tables 1 and 2 shows that the presence of coal particles significantly reduces slurry viscosity. A mixture of 50 percent coal, 35 percent water and 15 percent methanol had the greatest viscosity: $0.433 \cdot 10^{-3}$ Pa·sec.

The critical coal transport velocity depends on the carrying capacity of the liquid and can be determined by the solid particle settling rate.

The settling rates of coal in methanol, water and a 50-percent mixture of the two were studied using graduated cylinders. The test results are given in Table 3.

The coal settling rate in methanol, for both particle sizes, was somewhat greater than in water, due to the lower density of methanol ($\rho = 7.92$ N/m^3).

The coal settling rate in a 50-percent methanol solution with water was one-third of that in pure methanol, showing that a liquid mixture has a much greater carrying capacity than pure liquids. For coal particle sizes less than 0.5 mm, the carrying capacity of the fluids was 10-25 percent higher than for the coarser particle sizes.

Table 3. The Coal Settling Rate as a Function of the Liquid Phase Composition for Different Particle Sizes

Slurry Liquid Component Composition, %		Settling Rate, 10^{-5} m/sec	
Water	Methanol	Size 3-0 mm	Size 0.5-0 mm
-	100	1.38	1.25
50	50	0.41	0.36
100	-	1.11	0.83

An important practical consideration is the stability of the liquid mixture. It determines whether the slurry can be successfully transported after a pipeline shutdown or lengthy storage in a tank. The basic stability indicator of the liquid mixture is the intensity of separation, which can be increased with surfactants such as carboxymethylcellulose (KMTs) and polyoxyethylene (POE).

The coal settling rate, both in the presence and absence of surfactants, is determined over time by the relative depth of the settled layer n = 100 h/H, %, where h is the depth of the settled layer after a certain time, mm, and H is the height of the liquid mixture column, mm. The test results are given in figs 1 and 2.

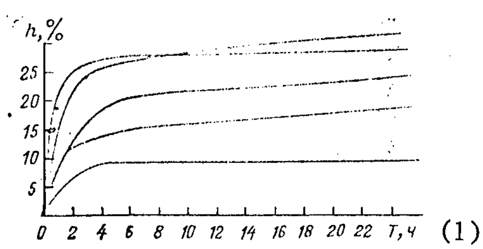

Figure 1. The Influence of Surfactants on Coal Settling in Water

Key:
1. T, hr

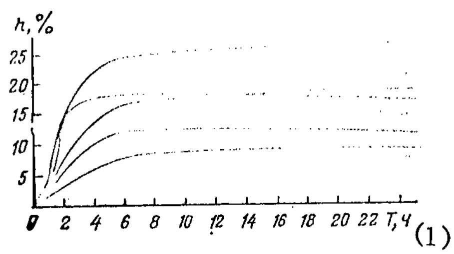

Figure 2. The Influence of Surfactants on Coal Settling in a Water-Alcohol Mixture

Key:
1. T, hr

The most intensive separation of the water-coal slurry was observed, for both pure water and for slurry containing surfactants, during the first two hours. After that, it gradually slowed down and ceased after 5-6 hours.

The separation process was retarded when the KMTs concentration in the water was increased from 0.5 to 2.0 percent and when the POE concentration was increased from 1.0 to 1.5 percent.

The settling of coal in a 50-percent water-alcohol solution (see fig 2) was much less intense than in the water slurry. The addition of surfactants (0.5 percent KMTs; 1.0-1.5 percent POE) intensified the process, although less so than in pure water. The addition of 2 percent KMTs into the water-alcohol mixture sharply reduced the slurry separation intensity.

Since the water-methanol mixture has a higher carrying capacity than either water or methanol alone, the mixture's critical velocity should be less. The mixture has a high viscosity and is more stable than water-coal mixtures. The water-methanol mixture's properties can be changed by the addition of proper amounts of surfactants. For these reasons, the water-methanol mixture is the most promising fluid for coal slurry transport.

12595
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NEW APPROACH PROPOSED TO BOLSTER DECLINING KUZBASS PRODUCTION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 Jul 84 p 2

[Article by T. Kobylyanskiy, chief geologist of Kuzbassugol' VPO [All-Union Production Association]: "The Section Next to the Mine"]

[Text] Kemerovo--In each of the last several years, the underground production of coal in the Kuznetsk Basin has been dropping. Several technico-economic indicators are worsening, such as loadings per mechanized working face and production cost. There are many reasons for this. But the main reason is the lack of a full working front. I must emphasize: this doesn't mean a lack of faces, but a lack of those faces that can produce high daily outputs.

No new mines have been developed for nearly a quarter of a century. The renovation of operating coal enterprises is proceeding at a pace that not only can't provide an increase in coal output, but can't even keep output at its present level. One by one, the most productive seams are being worked out. Therefore, the percentage of hard-to-mine seams is increasing. Such seams are thin, uneven, flooded or gassy.

It is hardly any surprise that, despite better miners' skills and improved mining equipment, the average monthly output per face last year was 76 tons less than in 1976, the best year. Due to this factor alone, total underground production in the basin fell by 4.5 million tons.

Considering the fact that there is no reason today to hope for a sharp increase in capital investments in new construction or renovation, it is obvious that the prospects for underground coal production in Kemerovo Oblast are unenviable. Nevertheless, the experience of several collectives shows that all is not lost.

The following examples confirm this. The Oktyabr'skaya Mine opened in 1950. For various reasons, it did not reach full production for several years. Then it was decided to build one more production area, using the mine's own capabilities. One kilometer from the shaft, an incline was driven from the surface to the Krasnogorskiy Seam. A boiler room and an air heater had to be built for the new section; a half-kilometer railroad track also had to be built. This was all done within a year. The new section began to produce 700-800 tons of coal per day. Labor productivity there reached 75 tons per worker per month, compared to 49 tons for the mine as a whole. The section was operated for 8 years, during which time it earned 8 million R for the mine.

A similar section at the Kuznetskaya Mine was even more efficient. It was also constructed within a year. Here, the daily output reached 1,600 tons. In 6 years of operation, it produced profits of 14 million R.

Similar separate sections were built and operated at the Imeni S. M. Kirov and Imeni 7 Noyabr' mines... Ten such sections have been worked at the Leninskiy Mine alone. In most cases, these sections were closed because they were worked out. Several of them eventually were connected to the main workings.

The practice of building and working separate sections continues today in Fizkul'turnik Mine Administration and at the Kol'chuginskaya and Tesntral'naya mines. Quite recently, a very promising section was opened at the Nagornaya Mine.

Of course, only a large, modern enterprise, with all its technological, auxiliary and service capabilities, can steadily produce a planned amount of coal over a long period of time. The separate section, though, can be worked for only a limited time, usually for about 10 years. Therefore, many specialists oppose such short-term projects.

One could agree with them if the circumstances weren't so difficult. Even if new mine construction were to begin during the current five-year plan, they wouldn't be in operation or up to full output anytime soon. All the while, we will be working out the present seams and moving to lower, more difficult seams. This will mean declining underground production.

Meanwhile, the geology department of Kuzbassugol' VPO has identified 25 areas where separate sections could be opened. The sections have recoverable reserves of 10-12 million tons. Both mine workers and coal production association specialists are convinced that these sections should be opened. There is no doubt that these sections are promising. In our opinion, it is practically the only possible way today to achieve significant production growth. It would not only help maintain present output, but could even increase it somewhat.

It seems that it may be possible to reverse the downward trend. However, a number of difficulties have arisen, particularly in preparing proven reserves.

Many areas selected for separate section development have significant coal reserves. But they have not been sufficiently studied to allow project development to begin. An example of this is the Yuzhnaya Mine. Over 1,000 people work there, producing only 1,000 tons of coal per day. Only 3 km away, isolated exploratory drill holes have found 3 gently sloping seams 1.5 to 3 meters thick. Mining machines could produce daily at least 1,000 tons of coal from these seams. Estimates show that no more than 150 people would be needed to work such a separate section.

Everything is favorable to opening a new section there. But the seams have not been studied in detail. Therefore, the new workings cannot be designed and developed. This is because the volume of exploratory drilling in operating coal fields has been reduced. As time passes, this will slow the growth of underground coal production more and more.

Long-time Kuzbass residents remember the time when 11 drilling crews were active at the former Kuzbassugol' Combine. They handled the drilling operations, while the geological work was done by Kuzbassuglegeologiya Specialized Trust of the USSR Ministry of Geology. But in 1970, these crews were reorganized into "their own" Kuzbassuglerazvedka Trust, in order to "augment geological exploration," as the order of USSR Minugleprom [USSR Ministry of the Coal Industry] stated. The new trust took on all final exploratory work for mine development. Ministry of Geology personnel were shifted to the search for promising new areas.

By itself, this decision was not questionable. The proposal was for geologists to carry out their own work, which is searching for new coal fields. The coal industry, along with production, is to do follow-up exploration in developed coal fields.

Everyting was properly planned. However, over time, the industry's geological service, rather than growing, "withered away." Today, the volume of exploration drilling done by Kuzbassuglerazvedka Trust has decreased to two fifths of what it was 15 years ago. Quite often, developments must be driven into seams that have not been properly explored.

And the costs are high. At the Tomskaya Mine, a mine deepening project was completed a year behind schedule. At the Pervomayskaya Mine, an incline to a 1,000-ton-per-day seam was also delayed for a year. The project design for the new, 6-million-ton-per-year Antonovskaya Mine was a year behind schedule. With insufficient preliminary exploration, ventilation drifts often have to driven.

This causes coal losses, non-productive mine workings and delays in preparing coal faces. The dilemma facing many mine managers is either to wait for exploration data or to venture into the construction of separate sections. The latter choice involves a certain risk, and excess expenditures are unavoidable because of incomplete geological data. The managers of the Fizkul'turnik Mine Administration and the Tsentral'naya Mine decided on the latter course. One understand their position. Better to bear some costs than to be left without any developed reserves.

The USSR Ministry of the Coal Industry formed its own trust, but did not worry much about equipping it. The time has come to pay for this poor management. The volume of exploration work is shrinking, while drilling costs are rising.

In addition, similar divisions of other sectors are operating in the Kuzbass parallel to the trust's organizations. In Leninsk-Kuznetskiy, for instance, five "independent" organizations are conducting drilling operations, while seven are operating in the Prokopyevsko-Kiselevskiy Coal Region. This scattered effort is clearly not advantageous. Obviously, it is time for the USSR Ministry of the Coal Industry and the USSR Ministry of Geology to objectively evaluate the state of exploratory and development drilling at the basin's mines. The number of small, "competing" organizations, with their multitude of offices and management personnel, must be reduced.

One other important detail must be noted in closing. Thirteen of the 25 areas favorable for the development of separate sections would produce scarce coking coals. This fact must also be considered when deciding whether or not to speed the development of these seams.

12595
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COAL

NERYUNGRI COAL PLANT SPEEDS TOWARD COMPLETION

Moscow PRAVDA in Russian 30 Jun 84 p 1

[Article by V. Yermolayev, PRAVDA correspondent, and M. Morozov, SOTSIALISTICHESKAYA YAKUTIYA correspondent: "The Buildings Will Rise in Neryungri"]

[Text] Neryungri, Yakut ASSR--The Neryungri Coal Beneficiation Plant is to be put into production in the fourth year of the five-year plan, according to the socialist obligations for RSFSR workers. The plant's annual capacity will be 9 million tons, making it the largest in the industry. The pace of competition between construction workers, installation workers, truck drivers and equipment suppliers is increasing daily at the construction site.

A. Pavlov, the chief engineer of Administration No. 13 of Yakutuglestroy Combine, spread out several drawings in front of two brigade leaders:

"There's the slurry basin for the thickener unit. You can use poured reinforced concrete here. Or, you could use precast reinforced conrete. The volume is the same--100 cubic meters. You decide."

V. Zazulyak, the supervisor of a Komsomol-youth brigade, liked the precast concrete idea. M. Mikheyev estimated that the plants of the construction industry had sufficient capacity. The concrete supply would be uninterrupted. Reinforcing cages were available. He spoke to his colleagues in favor of poured concrete. Which brigade would be the first to complete its part of the structure?

"Our young colleagues," replied M. Mikheyev, "are pleased with their success. We have also fulfilled our task. We completed our project in mid-April, as we promised to do."

Mikhail Alekseyevich did not mention that the youths had benefitted from his experience. Construction of the plant began seven years ago and he has been there from the very start. At that time, there were no construction industry enterprises around.

Over 100 brigades have participated in the workers' relay race competition in order to achieve this. They not only completed their own tasks, but also provided materials, equipment and work space to their associates. That's the way things are done here.

The advantages of consolidated brigades are quite obvious. M. Mikheyev supervises 100 people, while V. Kurchikov supervises 190. Experience has proven that such complex working groups are flexible to manage. They allow for the more effective application of resources and are able to better use their capabilities.

"If, rather than one large brigade, we were 6 brigades of 30 people each," says section chief M. Pestov, "we would have torn out our hair trying to make sure everyone got his share of the 'money' work. The same goes for dividing up a hundred kilograms of welding rods fairly and deciding when to provide concrete, cranes and tools to whom. Now, the collective itself solves these and a host of other problems. People know that they all are working on the same project. The input of each person will be evaluated using the labor participation coefficient. When people are fulfilling contracts, they pay more attention to the other workers involved: installation workers, workers from specialized organizations and finishers."

During a workers' relay race competition, contacts are made with collectives from numerous enterprises that supply equipment and materials to southern Yakutiya. These enterprises signed cooperative contracts with Neryungri, promising to speed the shipment of pipe, cable, wall panels and process equipment. It was all apparently done without slighting other customers. The construction staff, set up by the Neryungri CPSU Gorkom, thanked the pipe mill workers from Rustavi and the workers from the Khabarovsk Wall Structures Plant for fulfilling their obligations ahead of schedule.

The staff has other duties besides coordinating the actions of all the construction workers. It organizes competitions on the most important start-up projects and helps with educational work.

...The beneficiation plant's huge buildings, sheathed with aluminum panels, form a sparkling cascade down the gentle slope of the hill. The raw material--nearly a half billion tons of coking coal--lies hidden within the hill. Ten million cubic meters of overburden will have to be hauled away in order to begin producing the concentrate. A large amount of equipment has been concentrated at the pit: excavators with 20-cubic-meter buckets, 120- and 180-ton trucks and high-production drill rigs. Last year, the brigade of V. Yegorov, holder of the Miner's Glory Badge, removed 4 million cubic meters of overburden with a 20-cubic-meter Uralmash excavator. They have now resolved to better that achievement.

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COAL

RAILROAD COAL TRANSPORT PROBLEMS SOLVED IN UKRAINE

Moscow IZVESTIYA in Russian 10 Jul 84 p 2

[Article by A. Dolenko, IZVESTIYA correspondent: "Under the Deputies' Control"]

[Text] Kiev--When the Supreme Soviet of the Ukrainian SSR reviewed the republic's current five-year plan for economic and social development, the deputies' commissions made proposals on improving railroad efficiency and protecting against transport losses.

First, a few statistics. One fourth of all the tonnage carried by the railroads is fuel. About 90 percent of it is shipped from stations of the Donetsk Railroad.

"A study was made of the sector's junctions," said Yu. Bondar', chairman of the Transport and Communications Commission. "It showed that most of the problems of rail transport occurred there. We decided to work together with the Heavy Industry Commission."

A deputies' advance group, headed by V. Galkin, shift chief at Azot Association in Severodonetsk, visited the Donbass. Deputies in the group included railroad workers and miners; leading specialists from the sector were also invited. They visited worker collectives and got acquainted with their work and their problems.

"I visited Pavlogradugol' Association," said V. Bubnov, an honored miner of the UkSSR and a tunneling brigade leader at Dneproshakhtstroy Combine. "There are 11 mines here. Five of them have no hoppers. The coal is loaded as the rail cars arrive. However, they don't arrive with regularity."

"But, even if all the coal is loaded," said A. Yeremenko, brigade leader of the Imeni Dzerzhinskiy Mine Administration of Donbassantratsit Combine, "it doesn't always arrive at its destination on time, and much is lost along the way. Take, for instance, the Debaltsevo Station, where coal shipments are made up. In order to allow trains to pass freely, spilled coal is simply shoveled down the embankments."

The deputies saw many disturbing things at other mines and railroad stations.

Acting on the deputies' proposal, the republic's Minugleprom [Ministry of the Coal Industry] and the Donetsk Railroad management jointly analyzed the utilization of rolling stock at coal industry enterprises. They also investigated coal losses during transport. The UkSSR People's Control Committee also studied this problem and disciplined and fined a number of ministry and railroad personnel for their failures.

The members of the advance group reported on all of this at a joint session of the Supreme Soviet commissions on Heavy Industry and Transport and Communications. The performance of economic managers was objectively and strictly evaluated. The commissions presented their proposals and recommendations to the republic's Supreme Soviet Presidium for review. The Presidium approved them. UkSSR Minugleprom, the Donetsk Railroad management, Gosplan, Gossnab, People's Control Committee, the republic prosecutor's office, ispolkoms of oblast councils of people's deputies and ispolkoms of the Kiev and Sevastopol city counciles of people's deputies were instructed to eliminate shortcomings.

The commissions monitored the fulfillment of these decisions. It can now truly be said that things have improved.

"In order to realize the commissions' suggestions and proposals, as well as the statute of the UkSSR Supreme Soviet Presidium," said A. Kozhushko, chief of the Donetsk Railroad, "we orgainzed a conveyor-flow rail-car repair line. In order to avoid coal losses in transit, we are strictly monitoring how shippers comply with shipping regulations."

"The republic's Supreme Soviet commissions," noted V. Besedin, first deputy chairman of the Voroshilovgrad Oblispolkom, "have given us a good example of how to approach the study of a problem, monitor the fulfillment of decisions and achieve improved executive discipline. The permanent commissions of our oblast soviets and the executive committees regularly hear reports from coal and transport organization management."

The results of this are apparent. Since the beginning of the year, over 50,000 rail cars have been repaired by the railroad's Voroshilovgrad department. Mechanization has been introduced at many stations, tracks have been replaced and depots have been rebuilt. A deputies' watch at the Stakhanovugol' Loading and Transport Administration totally prevented fuel losses, saving 20,000 rail car-hours.

Overall, the republic's coal industry enterprises had an average rail car idle time of 6.4 hours, compared to the norm of 6.5. This saved 568,000 rail car-hours per year. The commissions of the Ukrainian SSR Supreme Soviet are constantly overseeing the realization of the recommendations. They are helping the miners and transport workers to make greater use of all their capabilities to fulfill the five-year plan.

12595
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WORK OF UNIT IN KARAGANDA COAL PRODUCTION ASSOCIATION PRAISED

Moscow UGOL' in Russian No 5, May 84 pp 3-4

[Article by I.R. Lifshits, engineer, Shakhtinskaya Mine: "On the Work of Working-Face Section No 3"]

[Text] Thanks to the efficient use of mining technology and the introduction of the scientific organization of labor, the collective of integratedly mechanized Section No 3 of the Karagandaugol' Association's Shakhtinskaya Mine, which is led by N.I. Gladkikh and is itself a leader in socialist competition among the working-face sections in the Karaganda basin, is increasing its coal extraction rate and improving its basic technical and economic indicators.

During the last 10 years the section's collective has repeatedly solved the most difficult problems successfully. Every time there was a change to a new mining area it was necessary to master new mining equipment and technology, answer questions concerning the transportation of the extracted coal, shore up the workings, and deliver and distribute materials and equipment.

The removable thickness of the bed changed constantly, depending on the type of complexes used and whether it was being extracted in one or two layers. In 1974, for instance, the collective worked on a short longwall, using a 1OKP complex, and extracted 1,200-1,300 t of coal per day. In 1976 the extraction was being done from paired longwalls, using 2OKP and 1OKP complexes, and the daily production load reached 2,400 t per day. In 1977 and 1978 the collective continued to work at the paired longwalls, but used 2OKP-70 and 2OKP complexes. The longwalls were supplied with electricity from a TKShVP [expansion unknown] substation that was on rails and moved ahead as the crew advanced along the longwall. The production load reached 2,600 t per day. With the introduction of 2OKP-70 complexes, in 1981-198w the rate of advance along the longwalls was about 230 m per month.

In 1982 the section tested and mastered the new 3OKP-70-1 complex, which was then used to work the entire thickness (4-4.2 m) of the ∂_6 bed. This was a new piece of equipment that had never before been used in the mine.

In 1983 the section worked the ∂_6 bed in longwall No 3, which is in the eastern section and is 90 m long. The geological conditions under which Section No 3 worked were complicated: the coal is self-igniting and the bed is dangerous because of sudden blowouts of coal and gas and explosions of coal dust.

A daily multiple-skill crew that consists of three extraction teams and one repair team works at the longwall. One of the most important factors in the collective's successful functioning is clearcut organization of the planned preventive maintenance of the equipment at the longwall. The repair team, which performs all the repair and preventive maintenance work, consists of 35-40 people. All the equipment mechanisms are assigned to group leaders who are experienced miners and electricians and are proficient at several allied skills. Each repair team group is assigned equipment, for the emergency-free functioning of which it is responsible from the moment the equipment is set up until it is through being used.

The work at the longwall is organized in the following manner. Preparation, repair and adjustment of the conveyor lines are carried out by two groups: the mechanical part is the responsibility of six electricians, whereas the preparation for operation of the electrical part and the automatic equipment is taken care of by two electricians and one miner.

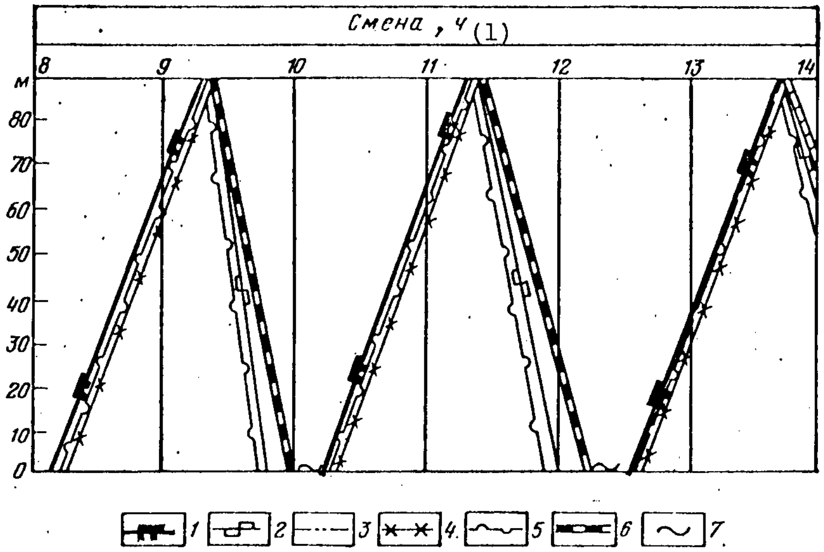
The maintenance of the KSP-2 reloader and the SUOKP-70 longwall conveyor, the checking of the reduction gears and the pull-type devices, and the preparation of the reloader for shifting are the responsibility of three miners.

Three electricians service the power trains and check the face machinery's electrical equipment, control circuits and warning signal units. Two working-face miners, under the supervision of an electrician, observe the functioning of the road (UDLG [expansion unknown]) over which the materials and equipment are delivered. A group of miners takes care of repairing the mechanical part of the complex and replacing the SUOKP-70 conveyor's chutes. Delivery of materials and equipment to the longwall over the UDLG fill roads is carried out by six miners. The section's mechanic supervises all repair work.

This organization of the work made it possible to reduce the machinery and mechanism accident rate significantly and increase the machinery operating time on the extraction shifts.

During the extraction shifts people are assigned working places with due consideration for their experience, knowledge and professional skills. There is a clearcut distribution of responsibilities among them and operations are assigned permanently to miners. The planned working schedule for Section No 3 is presented in the figure on the next page.

On the shift extraction teams that actually mine the coal, there are 10-11 working-face miners. A machine operator and his helper receive the KSh-Zm combine from the preceding shift and check the status of the cutters and their attachment to the worm conveyors, the presence of oil, the condition of the feeder system and the reliability of the hauling chain. The other members of the extraction team check the readiness of the longwall conveyor and the duty electrician sees that the hydraulic and electrical equipment is in good working order. After this, coal extraction begins. When the combine is moving upward, 2.5 m of the upper band of coal are extracted, with the other 1.5 m being extracted when the combine is stripping downward. The combine's operator and his helper monitor the status of the roof and the face, the location and status of



Planned working schedule: 1. extraction of coal by combine; 2. moving of combine and stripping of soil; 3. moving of support timber sections; 4. stripping of support timber bases; 5. trimming of face; 6. movement of conveyor; 7. preparationg for extraction.
Key: 1. Shift, hours

Показатели (1)	1977 г.	1980 г.	1981 г.	1982 г.	1983 г.
Добыча угля, тыс. т(2)	777,1	915,3	950,2	1011,3	1013,7
Производительность труда рабочего по лаве, т/мес(3)	556,4	587,1	604,2	623,1	626,9
Численность рабочих, человек (4)	111	184	177	175	180

Key:
1. Indicators
2. Coal extraction, 10^3 t
3. Labor productivity per longwall worker, t/month
4. Number of workers

the cables and hoses, and the normal functioning of the feeder nozzles. Two miners shift the mechanized support timbers or the conveyor, depending on which way the is moving. Six of them shift the KSP-2 reloader on the conveyor drift, along with the longwall conveyor drives and the linking support timbers, prepare the bays, and split off-sized pieces of coal. All the processes in the cycle are almost completely contemporaneous with the combine's extraction of the coal.

The introduction of progressive technology and the scientific organization of labor, as well as the clearcut, harmonious and timely work done by all the teams in the technological chain have also contributed to the efficient use of the mechanized 3OKP-70-1 complex. Shift-by-shift accountability for the performance of each group's, team's and shift's work and constant monitoring of the teams' work by the leaders have created conditions for achieving high results.

The basic results of Section No 3's work during the period under discussion are presented in the table.

The section's collective did not reach the million-ton mark immediately. From year to year the amount of coal extrated grew, labor productivity increased, and coal production costs dropped. These successes were achieved thanks to constant working with the people and the mobilization of the collective to fulfill the socialist obligations it had assumed.

The collective led by N.I. Gladkikh is an active participant in the "500,000-Ton" movement at the Karagandaugol' production association. In 1982 it emerged as the victor in the socialist competition seven times and it has been awarded the Challenge Red Banner of association and the territorial committee of the coal industry workers' trade union.

In 1982 the members of Section No 3's collective introduced 15 innovators' suggestions that had an economic effect totaling 284,000 rubles.

By the Miner's Day professional holiday, the section's collective had extracted 109,200 t of above-plan coal.

In 1983 the section's collective decided to mine more than 1 million t of coal, and coped successfully with its assumed obligations. The final figure was 1,013,707 t.

In 1984 the collective led by N.I. Gladkikh has vowed not to let its work rate drop and to send at least 1 million t of coal to the surface.

11746
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TECHNIQUE FOR WORKING HIGHLY STRESSED STRATA EXPLAINED

Moscow UGOL' in Russian No 5, May 84 pp 19-20

[Article by F.V. Sysolyatin, candidate of technical sciences, Urals Branch, All-Union Scientific Research Institute of Mine Surveying: "Improving the Drilling of Relief Boreholes in Highly Stressed Strata"]

[Text] The Kizelovskoye coal field has the most highly stressed strata of all fields. More than half the rock bursts registered in this country have occurred there. The implementation of a complex of measures to combat the bursts made it possible to reduce their number per million tons of coal extracted by a factor of 35 between 1960 and 1980, despite the fact that the depth of the workings almost doubled. However, it is still impossible to eliminate the explosions comletely.

Along with regional measures for preventing dynamic phenomena when working a series of strata, extensive use is made of local preventive measures: the injection of water into a stratum, the drilling of large-diameter relief boreholes, the underground detonation of explosive charges, The method used most widely to combat rock bursts at the mines in the basin is relieving a stratum with a large-diameter borehole. More than 40,000 m of large-diameter boreholes are drilled in the working and development faces every year. Relief boreholes 10-15 m long and 200-500 mm in diameter are used to free 80 percent of the underground workings in stressed strata from explosions.
"Start" and BGA [expansion unknown] rigs are used to do the drilling.

The experience amassed in working explosion-prone strata indicates that it is possible to use relief boreholes under variegated and complicated conditions. This method is particularly effective when clearing away previously abandoned coal pillars, where other local preventive measures are not suitable. Boreholes also have a good relieving capability during the working of a solitary thick bed, since the underground detonation of explosive charges and water injection into the stratum are not very effective.

The drilling of relief boreholes in a stressed mass of coal results in a reduction of the stresses in some area because of the coal's transition into a limiting state. An intensive discharge of rock pressure takes place during the drilling of boreholes, with its realization being in the form of bursts and explosions accompanied by the squeezing-out and blowout of coal from the edge of

the bed. Pulses that are particularly significant in both amplitude and frequency of appearance can be observed in highly stressed sections of strata with Category I stress factor. In connection with this, the highest probability of initiating dynamic phenomena occurs during the drilling of boreholes in a maximally loaded zone located at a distance of two or three times the thickness of the stratum. As a result of the introduction of the cutting tool into the stratum, there appear additional local loads that create an anomalous stress field with a critical potential at the point of contact between the drilling bit and the borehole's wall. The greatest danger occurs in connection with the drilling of boreholes 400-500 mm in diameter. VNIMI [All-Union Scientific Research Institute of Mine Surveying] research has established that the greater the diameter of the relief boreholes, the higher the intensity of the stratum's discharge of stress; on the other hand, reducing the diameter of the rotating element results in a reduction in the boreholes' relieving capacity.

In some sections of a bed the blowouts of coal are so severe that they result in the breaking of the drilling equipment and, as a rule, squeezing and deformation of the guide rods. In the last 3 years alone, the number of rock bursts that were related to the drilling of relief boreholes was 40 percent of all those registered. For instance, a rock burst that occurred in May 1979 during the cutting of longwall No 714 at the Mine imeni Krupskaya resulted in the protracted abandonment of the working face. The burst was caused by the drilling of relief boreholes 500 mm in diameter. Before the use of preventive measures, Category II stress factor was recorded for this section of the stratum. During the drilling there was a redistribution of the stresses in the edge part of the stratum, which initiated the rock burst.

During the drilling of relief boreholes 500 mm in diameter in longwall No 292 at the Tsentral'naya Mine, there occurred a rock burst with an energy level--according to the Ugleural'sk seismic station's data--of 10^5 J. As a result, the edge part of the stratum was completely destroyed for 30 m along the strike and to a depth of 1.2 m. The burst was accompanied by a significant blowout of coal and the formation of a large amount of dust.

Under particularly complicated conditions for working explosion-prone strata, there have occurred incited bursts in connection with the drilling of boreholes less than 500 mm in diameter. For example, a rock burst that took place in the Tsentral'naya Mine's longwall No 921 was caused by the drilling of relief boreholes 250 mm in diameter. The longwall was being used to work solitary, burst-hazardous stratum 11, which was 0.9-1.3 m thick and lay at a depth of 600 m and sloped at a 30-40° angle. The stratum's basic roof and soil were quartz sandstone. The working system was continuous and roof control was by partial laying. The coal in the longwall was being removed by a 1K-101 combine. The support timbering consisted of wooden frames put in place every 0.9 m. Round timber chocks were used as special timbering. The edge part of the bed along the entire longwall was characterized by Category I-II stress factor. The relief boreholes were 9.8 m deep, and the distance between them was 1.5. A mine shock occurred during the drilling of the boreholes in the upper part of the longwall. In connection with this, the drilling bit was deformed and the rig's guide unit broke. Coal from the stratum's edge part was blown out to a depth of 1.5 m in a section 8 m long.

An analogous burst was caused by the drilling of boreholes in longwall No 621 in the section workings at the Mine imeni Lenin. The longwall was being cut into in stratum 11, which was 0.9 m thick and lying at an angle of 55°. The stratum's soil and roof were argillites of average stability. Section working was being done for the purpose of lengthening the longwall to the full length of the level.

When the opening-out raise was driven to a distance of 18 m from the vent drift in the face, Category I stress factor was established. In accordance with the plan for bringing the edge parts of the workings into an unstressed state, the face and the side walls had relief boreholes that were 150 mm in diameter drilled into them to a depth of 4.1 m. During the drilling of the boreholes there was intensive squeezing-out of coal and pinching of the drilling tool. The amplitude of the individual elastic impulses reached 200 mA. Reducing the diameter of the drilling bit to 110 mm did not result in a reduction in the stratum's seismoacoustic activity. During the drilling of the next borehole there was a loud bang and coal was blown out of the stratum's edge part. In the face, the support timbering was knocked out and the safety shelves were destroyed.

Such situations are not unique in highly stressed strata and, as a rule, are accompanied by increased danger during the implementation of preventive measures, in connection with which it is sometimes necessary to leave in place coal that has been prepared for removal. For instance, during the working of longwall No 611 at the Mine imeni Lenin, significant reserves of coal were left in stratum 13 because of the impossibility of relieving stress in the stratum edge. For this same reason, separate sections of strata with a high stress factor were abandoned at the Zapadnaya and Tsentral'naya Mines and the Mine imeni Krupskaya.

Special mining equipment to relieve stress in coal strata has not yet been created, although local measures of combatting bursts have been developed and have been in use in the mines for more than 20 years. The mechanisms and devices used for this purpose (combines, electric drills, drilling rigs, pump units and so on) are not suitable for use under conditions of increased stress and do not guarantee labor safety when they are being used. For example, the "Start" drilling rig, which has remote lengthening of the drill rods, has an imperfectly designed magazine-type feed: every drill rod must be set into the socket manually, so the use of the feed mechanism complicates the work when drilling boreholes. This rig also has other design flaws that show up when it is used to relieve stress in strata edges.

The development of new or the modernization of existing drilling units, featuring automatic regulation of the feed rate and frequency of rotation of the cutting tool, as well as remote or programmed control of the entire unit, will facilitate an improvement in the effectiveness of preventive measures for combatting rock bursts, as well as an improvement in the technical and economic indicators of mine work.

Calculations made for the "Start" drilling tool show that if it is modernized, the annual economic effect from the use of even a single one will be 13,400

rubles. The improvement of narrow-wedge combines (in the direction of automatic regulation of the feed rate and remote operational control) can open broad possibilities for their safe use not only in mines where there is a danger of shock, but also in steep or sloping strata in which there is a danger of blowout. The economic effect from the use of a single 1K-101 combine will be more than 200,000 rubles per year.

It should be mentioned here that with the deepening of underground workings the probability of rock bursts is undoubtedly increasing. Under these conditions the problem of extreme stress and the development of measures for combatting dynamic phenomena will be even more complicated. In connection with this, the planning and design institutes need to examine the question of developing and creating both mining technology and working-face equipment that meet the needs of the mining industry for working highly stressed, explosion-prone strata.

11746
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METHOD FOR DEALING WITH SELF-IGNITING ROCKS DESCRIBED

Moscow UGOL' in Russian No 5, May 84 pp 24-25

[Article by P.A. Burkov, candidate of technical sciences, and A.I. Chirkin and V.A. Grintsov, engineers, NIIOGR [possibly Scientific-Technical Institute for the Organization of Mine Working]: "Nontransport System for Working Deposits Containing Self-Igniting Rocks"]

[Text The Krasnoyarsk Coal Production Association's Chernogorskiy Open-Pit Mine is working the Velikan, Moshchnyy and Gigant-1, -2 beds, which have a total thickness of 15-20 m and lie at an angle of 5-10° in the northwestern part of the Chernogorskoye field. The thickness of the covering rock is 40 m. The work is being done by a composite system. The rock overburden is being removed by both the nontransport and transport methods. EKG-4.6, EKG-8, ESh-15/90 and ESh-10/60 excavators are being used at the mine. Railroad (with steam traction) and motor vehicle transport are used to move the rock mass.

Coal (hard, humic, and candle) is used as fuel.

The rocks in the outer overburden are sandy loams, aleurolites and sandstones, whereas those in the interbed area of the Velikan and Moshchnyy beds are coaly argillites and those between the Moshchnyy and Gigant-1, -2 beds are aleurolites.

One special feature of the coals and coal argillites (particularly the latter) is self-ignition, as a result of which many endogenic fires start at the mine. Investigations of the fire hazar of the coals in the Chernogorskiy Open-Pit Mine showed that fires appear primarily in coal columns where they come in contact with internal dumps (the Gigant-1, -2 beds), in piles containing coal and rock, in the internal dumps of nontransport overburden and in bulldozed dumps.

The basic causes of this high degree of fire danger are: losses of coal in the form of piles and mounds that form during the working and stripping of benches in the Gigant-1, -2 beds and the presence in the rock mass of dumps of nontransport overburden and bulldozed dumps placed on top of them, as well as combustible components in the form of coal (from the stripping of the beds) and coaly argillites.

The rock mass's combustible component content varies within wide limits, although they occur most often (26.5 percent) in the overburden rocks of the

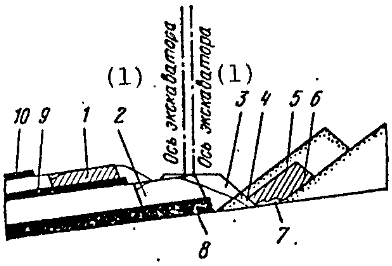

Diagram of conduct of dump work in connection with nontransport system of working: 1. upper (coal-containing) interbed area; 2. lower interbed; 3. predump; 4. preventive buffer; 5. inert rocks; 6. coal-containing rocks; 7. safety cushion; 8. Gigant-1, -2 beds; 9. Moshchnyy bed; 10. Velikan bed.
Key: 1. Axis of excavator

Moshchnyy bed, which--in accordance with the overburden work and dump formation techniques in use at the mine--are placed in internal bulldozed dumps for transport by motor vehicle. For this reason, bulldozed dumps offer the greatest fire hazard.

The methods for preventing endogenic fires in the internal bulldozed dumps that have been recommended and are being used at the mine come down to establishing their optimum geometric parameters and insulating their surfaces with inert rocks. This has a definite effect, but does not eliminate completely the appearance of fires, and also requires significant expenditures of materials and people's time.

Besides this, stripping the lower bench of the outer overburden and the rocks in the interbed area between the Moshchnyy and Gigant-1, -2 beds by the nontransport method and the Velikan-Moshchnyy interbed (which is located between them) by the transport method creates a heavy dependence on the operation of excavators and complicates the organization and increases the cost of the overburden work. In connection with this, and also in view of the development of a technical plan for stripping the Chernogorskiy's reserve section No 2, there has arisen the need to develop an effective method for combatting endogenic fires in the internal dumps.

NIIOGR, together with workers from the Chernogorskiy Open-Pit Mine and Vostsibgiproshakht [probably Eastern Siberian Institute for the Planning of Mines], developed a method that makes it possible to eliminate endogenic fires in internal dumps. The method of conducting dump work is shown in the figure. In this case, all the overburden work in the interbed areas is done by the nontransport method, using an ESh-15/90 dragline. The stripping of the upper and lower interbed areas (see figure) is done in one working pass, with movement of the dragline toward the dump. The explosive work is done simultaneously for both interbeds. During the working pass, the excavator's operations are in the following sequence: it moves the rocks from the lower interbed into a temporary pile (the predump), pours a protective cushion on them, places coal-containing rocks from the upper interbed on top of the cushion, and then insulates them with inert rocks from the predump, with the remainder of the predump being lift as a protective buffer that separates the Gigant-1, -2 coal stratum of the coal-containing rocks in the dump.

Thus, the pouring of the coal-containing rocks onto the protective cushion (which consists of inert rocks) behind the predump and the insulation of the coal-containing rocks' surface with inert rocks from the predump (with the rest of the rocks in the predump being used as a protective buffer), which is all accomplished during one working pass of the excavator, provides complete

insulation of the coal-containing rocks and prevents air from getting to them. This eliminates the possibility of the appearance of endogenic fires in an internal dump and the spread of these fires to the coal seam.

The elimination of endogenic fires increases work safety and reduces pollution in the zone where the extraction work is done.

The method that has been described has been adopted in the plan for stripping reserve section No 2 at the Chernogorskaya Open-Pit Mine.

11746
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RUMYANTSEV MINE DIRECTOR OUTLINES EFFICIENCY IMPROVEMENTS

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 pp 4-7

[Article by A. S. Doroshenko, director, Mine imeni Rumyantsev: "The Main Factor for Improving Production Efficiency"]

[Text] The growth in labor productivity at all links in the production process, from working face to surface, is of great significance for improving production efficiency at mines. The Mine imeni Rumayntsev, Artemugol' Association is giving constant attention to this in light of decisions of the December (1983) and Februrary (1984) CPSU Plena.

The Mine imeni Rumyantsev has an 850,000 ton annual production capacity, which 104.3 percent utilized. It is working 15 thin steeply dipping seams from 0.5 to 1.6 m thick. The coal is grade OS. The field was openedby three centrally located vertical shafts and crosscuts in levels. The freight and personnel cage winding equipped shaft No.1 was sunk to 1,090 m, rock skip No. 2 to 850 m, and coal skip No. 3 to 1,090 m.

The mine field is 5 km long along the dip. Coal is extracted from horizons 730, 850 and 970 m. The average monthly number of working faces is 17, 10 of which are equipped with Temp and Poisk-2 combines with individual supports and shield assemblies.

Coal seam development is hindered by high gas content, frequent gas dynamic phenomena and increased rock and air temperatures. The reconstruction and modernization of the main links in the production process will ensure the enterprise's normal operation.

Special technological measures are being taken to control wall rock. The procedure for working seams is strictly regulated to prevent dynamic and gas dynamic phenomena and to use the protective effect of extraction stopings of adjacent seams. Forecasts of blowout danger and special methods for working seams are utilized. Stationary and mobile air conditioners are used to cool faces with higher air temperatures.

The mine has developed and is implementing technical and organizational measures to carry out tasks outlined by 26th CPSU Congress and 27th Ukrainian CP Congress decisions. The most important of these technical measures are: increased loadings at comprehensively mechanized faces, the production

introduction of scientific and technical achievements, improved labor protection and safety, the rational use of fixed capital, improved quality, economies on material and energy resources, improved use of work time and efficiency and the concentration of capital investments on the most important production sections.

Table 1. Mine Indicators

	Indicator Показатели	1981	1982	1983 г.
1.	Общая добыча угля, тыс. т	794	850,9	886,3
2.	Среднесуточная добыча, т	2264	2419	2505
3.	Количество действующих лав	17	18	17
4.	Месячное подвигание линии очистных забоев, м	28,1	26,5	26,9
5.	Суточная нагрузка на лаву, т	122	123	137
6.	Объем механизированной добычи, тыс. т	328,5	390,7	381,8
7.	Уровень механизированной добычи, %	45	46	48,9
8.	Объем прохождения основных подготовительных выработок, км	25,1	25,6	26,6
9.	В т. ч. вскрывающих и подготавливающих, км	12,6	12,8	13,2
10.	Месячные темпы прохождения, м	66	68	69,2
11.	Месячная производительность труда рабочего по добыче угля, т	23,2	25	25,9
12.	Трудоемкость работ по добыче 1000 т угля, чел.-смен	1258	1171	1145

Key:
1. Total coal extraction, 1,000 tons
2. Average daily extraction, tons
3. Number of longwalls operating
4. Monthly longwall advancement, m
5. Longwall daily loading, tons
6. Mechanized extraction volume, tons
7. Level of mechanized extraction, percent
8. Development working driving, km
9. Opening and preparatory working driving, km
10. Monthly rate of driving advance, m
11. Monthly labor productivity in extraction, tons
12. Labor intensiveness of extracting 1,000 tons of coal

Problems in the enterprise's production and economic activity are under constant control by the enterprise management and public organizations. Special attention is given to labor productivity, one of the most important economic indicators characterizing production relations, technical progress, the degree of equipment use, and labor and production organization.

The table presents data on the mine's operation in 1983, compared to 1981 and 1982. Extraction labor productivity increased mainly through quantitative

growth in extraction. This required the collective to mobilize and fully use reserves. Increased extraction became possible through mining operation mechanization and concentration. Thus, while in 1981 extraction was 45 percent mechanized, in 1983 the figure was 46 percent. Reductions in intrashift idle time increased average daily loading by 86 tons in 1983 compared to 1982, raising it to 2,505 tons. The reduction of technical breaks and improvements in technology are ensuring annual increased in mechanized work volumes.

Other factors also have major roles in labor productivity growth. The improvement of repair work organization has made it possible to raise monthly labor productivity per extraction worker from 23.2 tons in 1981 to 25 tons in 1982 and 25.9 in 1983.

A properly selected development system is promoting successful work. Attention is given to working procedures in compiling a calandar plan for stoping series of seams. The main factor in this order is mine pressure and its manifestations.

In operations at small depths (300 - 400 m), where rock pressure is manifested only in wall rock behavior, attention was rarely given to the mutual influence of working seams in a series; the most productive were taken first. As movement progressed to the deeper horizons there were changes in the effects of pressure: together with deterioration in wall rock stability, there was a sharp rise in gas dynamic activity in seams. This was in the form of sudden blowouts of coal and gas and in rock bursts. This required the use of preventitive measures which were very labor intensive and not always effective. The mine switched to the field preparation of stoping sections. This involved digging drifts 5 - 6 m under explosion prone seams , and working seams through inclined blind shafts driven by Strela machines or by the drill and blast method.

The Ukrainian Affiliate of VNIMI [All Union Scientific Research Intitute for Mining Geomechanics and Mine Surveying], Makhnii [Expansion unknown] and Artemugol' are of great help to the mine great help in the solution to problems arising in connection to changes in the seam working procedure. Thus, a group of mine and association specialists suggested the introduction of non-shrinkage stoping for the especially dangerous seams L-v-7 Pugachevka and L-6 Izvestnyachka and to use squall blasting to cut niches for combines (first used at mines in Tsentral'niy Rayon, Donbass). These measures increased loading per longwall. The transition has been completed to pillar free working of protective seams and field working of blow out prone seams. Due to this the tunneling rate for main preparatory workings was 360 greater in 1983 than in 1982.

Measures are intended for the following: improved condition of mine workings, increases in their interrepair period of operation and support, increase the cross sections of major workings and use metal support arches made from low alloy steel. The number of supports needed has been determined, their daily operation is accounted for and controlled. This helped reduce the number and length of workings not meeting Safety Rules.

Keeping stoping drifts in working condition is especially urgent for mines in Tsentral'niy Rayon, where work is at great depths, with intensely increasing rock displacement and roof pressure. The mine constantly tries to give consideration to repair-free support in locating workings. The relief effect of former haulage drifts is used in driving seam ventilation drifts. These drifts are located in zones of relief due to the exhaustion of haulage drifts and cut into roof rock. When relieved rock is unstable, ventilation drifts are driven into the roof 0.5 - 3 m from the seam and the rock is moved to a worked out section of longwall. If there are block (intermediate) crosscuts in the forward levels they are linked with ventilation (haulage) drifts.

Ventilation drifts for shield panel longwalls are driven in the footwall 10 - 20 m from the seam. This assures their working condition throughout service life, with minimal outlays for maintenance. As a result of measures for the repair-free maintenance of workings, in 3 years of the 11th Five-Year Plan the mine has reduced their total distance by 4,605 m.

Much is done to assure the prompt preparation of working face lines. New tunnel driving equipment is being introduced and labor organization improved. The mine is using GPK tunnel driving combines, shotholes in development faces are drilled by BU-1 units and the more modern PPN-5P rock loaders are used instead of the PPN-1S. For 2 years 2 tunnel driving brigades have been working at a fast pace, their monthly advance rates are more than 120 m.

Introducing progressive methods for work organization, A. G. Petrov's brigade has signed a contract covering the brigade contract work method. This has made it possible to increase the monthly advance rates of main workings from 66 m in 1981 to 69.2 in 1983, improve tunnel drivers labor productivity and provide the mine with the necessary working face lines.

The labor intensiveness of the main extraction processes declined during 1981-1983. ANShch mechanized complexes made it posssible to reduce total labor outlays for mucking operations and manual and physical labor in general. Total labor outlays per 1,000 tons of coal at comprehensively mechanized faces are 2 - 3 fold lower than at remaining faces. The number of workers engaged in manual labor could be reduced through the more complete use of the potentials of equipment and technology and improvements in work and production organization.

Mine innovators are also helping to reduce the numbers involved in heavy physical labor. In 1983 they introduced 244 innovator suggestions with an annual economic effect of 315,200 rubles. At the suggestion of innovators, multi-stage haulage at the surface has been eliminated and trucks are used to haul rock to outside the mine area, getting rid of rock dumps. Overhead wire electric prime movers have been replaced by battery units. Supporting the reliable operation of surface facilities, this has made it possible to reduce the number of workers here by 38. The introduction of new techniques for repairing mine electric locomotive batteries and cars has improved their reliability and longevity. Measures have been worked out and introduced to reduce the number of personnel by combining jobs and expanding service zones. In 1983 combined jobs released 22 people and zone expansion released 24.

The introduction of scientific labor organization [NOT] is assisting in labor productivity improvements. There are 496 working face workers (collectives in sections No. 70, 81, 82 and others) now covered by comprehensive NOT plans. Sections systematically overfulfilling coal extraction plans have significant influence in improving labor productivity growth rates. Great attention is given to improving technical norming as one of the conditions for improving labor productivity. Measures are taken to organically link norms to payments for labor. Workers, trade union organizations and engineering and technical workers are actively participating in solving norm setting problems. A special section of the collective contract lays out the obligations of administration and workers to improve the standards of technical norm setting and reduce labor intensiveness. There are 317 norm sites at the mine and 99.6 percent of workings are covered by technically based norms.

The further development of collective forms of labor organization and payment are of great importance. The enterprise has created 23 brigade councils and a 13 member brigade leaders council. A permanently operating commission coordinates the brigade form's introduction. A total of 165 brigades with 2,260 members have been organized. Great work has been done to liquidate leveling of wages. Collectives constantly control existing norms for work and payment conditions.

The tautness and fulfillment of section and work place norms are constantly analyzed. Meetings examine work organization and make suggestions for its improvement, progressive workers share their experience. The production and economic services set competition conditions by profession. Development system designs provide for bench lengths to assure face worker norm fulfillment of at least 110 percent. The use of workers in the main professions for auxiliary operations is not permitted.

Coefficients of labor participation, ranging from 0.7 to 1.3, with 0.1 intervals, are used at 43 comprehensive brigades. Workers, brigade leaders and the trade union committee actively participate in working out the statute on awarding bonuses. At the suggestion of N. S. Krasnobryzh and L. I. Gaspirovich, development section brigade leaders, differential bonuses in groups, depending upon plan tautness have been established.

The piece rate bonus payment per unit of final output (1 ton of coal, 1 meter, 1 cubic meter of tunnel driving, the installation and removal of shield units, etc) has been approved in order to further improve collective forms of pay and intensify their role in attaining final results, improve labor productivity, strengthen technological discipline and observe safety rules for comprehensive brigades at working and development faces. Payment for final results is based on the value of output per shift, day, week or month; 1,458 people, or 95 percent of all piece rate workers have been converted to such payment.

The mine is improving the forms and methods of norm setting for time rate workers. Their norms are set on the basis of norms for output, servicing and number of workers. Regulations cover the procedure for setting targets, controlling and accounting for fulfillment, evaluating completed work quality and material incentives depending upon the quantitative and qualitative indicators attained. Thirty percent of time rate workers have been switched to normed targets and the number of such workers reduced by 4.2 percent.

The widespread introduction of normed targets has promoted production efficiency. Concurrently, improved labor productivity, the high quality and timely completion of auxiliary processes has increased coal extraction by 6.5 percent. Improvements in repair and installation quality at working faces has helped reduce machinery idle time due to breakdowns by 2.2 percent and the production of an additional 6,000 tons of coal annually. Thanks to a 3.1 percent reduction in time losses in mine transportation, with the conversion of IInd wage category workers and electric locomotive engineers to normed targets, approximately an additional 5,000 tons of coal have been extracted and 225 extra meters of tunnels driven.

Great attention is given to competition to complete 11th Five-Year Plan targets ahead of schedule. Faceman I. Ya. Golubyatnikov, the initiator of "The Five-Year Plan in Two and a Half Years!", completed his on 10 August 1983, cutting 7,890 tons of coal with a pick hammer, fulfilling his norm by almost 200 percent. Eighty six facemen at the mine are working on their 1985 account. Extraction secton collectives have organized competition under the slogan "Fulfillment of Annual and Five-Year Plans Ahead of Schedule". It is directed towards improving labor productivity by 1 percent and reducing production costs by 0.5 percent. Remarkable work is being done by the collective of section No. 81 in seam L-3 Mazurka. Average monthly loading at the longwall exceeded 11,000 tons, with a plan of 8,650 tons, monthly labor productivity per worker increased to 120.2 tons, with a 93 ton plan. The average monthly advance rate of the working face line was 63 meters; the plan is 46.4 meters.

The section pays attention to the dissemination of progressive experience. At the initiative of the facemen L. P. Kliment'yev, A. V. Makeyev and A. I. Ishmatov the longwall was broken into 12 benches and the height increased by 2 meters. Output norms were increased by 5.2 percent, reaching 10 tons per shift and were 110 percent fulfilled.

Labor discipline and legal violations are constantly supervised by party and trade union organizations, section and shop chiefs. Every case of absenteeism, drunkenness and other violation is thoroughly examined and analyzed. The mass media, the newspaper GORLOVSKIY SHAKHTER, the information bulletin for labor legislation, a radio-paper and a wall paper are used for propaganda. A review-competition for trade union groups has been organized under the slogan: "Discipline and Organization at Each Workplace!"

The collective at the Mine imeni Rumyantsev, using its experience, is working to improve the organization of labor and production. Based on available reserves, it has set a new goal: improving labor productivity by 5.6 percent by the end of the 11th Five-Year Plan.

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COAL

DONBASS ASSOCIATIONS NAME PRODUCTION GOALS

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 p 1

[Editorial: "A Worthy Celebration of the Stakhanovite Movement's Jubilee"]

[Text] In August 1985 the Soviet people will mark a famous date -- the 50th Anniversary of the Stakhanovite Movement. The Politburo of the CPSU Central Committee has supported the initiative of labor collectives in the coal, metallurgical and other sectors expanding socialist competition to fulfill a number of important indicator targets of the 11th Five-Year Plan by the 50th Anniversary of the Stakhanovite movement.

It is noteworthy that this movement, which quickly became national, covering workers at all enterprises, construction sites, sovkhozes and kolkhozes in the country, originated in the Donbass -- an All-Union coal boiler room. In August 1935, at the Central-Irmino Mine [now the Mine imeni 22th CPSU Congress, Stakhanovugol' Association], the faceman Aleksey Stakhanov, using a new breaking method, dug 102 tons of coal in a shift, 14 fold the shift norm.

Donbass miners are continuing and multiplying the glorious traditions of the heroes of the first five-year plans. The brigade of V. I. Ignat'yev, a USSR State Prize winner at the Krasnolimanskaya Mine in the Krasnoarmeyskugol' Association is showing an important example: On a Communist Saturday in April 1984 it hoisted up 10,513 tons of coal from one longwall, setting a mining equipment productivity record.

Collectives at many mines, successfully implementing the decisions of the 26th CPSU Congress and subsequent plena, are assuming increased socialist obligations to worthily celebrate the jubilee of the Stakhanovite Movement.

By this date the collective at the Mine imeni Stakhanov, Krasnoarmeyskugol" Association plans to produce 150,000 tons of above-plan coal, increase average daily loading per working face to 880 tons, improve labor productivity of extraction workers by 1 percent over the plan, save 430,000 rubles through reductions in fuel production costs, reduce the ash content of fuel shipped by 0.1 percent compared to norms and drive an additional 1,200 meters of mine workings.

At the Trudovskaya Mine, Donetskugol' Association, the extraction section collective led by Hero of Socialist Labor I. I.Strel'chenko decided to complete the 11th Five-Year Plan target for coal extraction by the jubilee date, improve labor productivity by 2 percent and reduce coal production costs by 2 percent.

Miners at the Torez Mine Administration, Torezantratsit Association have outlined big goals: by the 50th Anniversary of the Stakhanovite Movement they plan to fulfill the five-year plan target for coal extraction, produce an additional 188,000 tons of coal, exceed labor productivity targets by 1.5 percent, reduce coal production costs by 0.5 percent and ash content by 0.2 percent.

The following have obligated themselves to complete the 11th Five-Year Plan by this date: Kommunist Mine (Oktyabr'ugol'), the imeni Zasyad'ko (Donetskugol'), imeni Bazhanov and Krasnogvardeyskaya (Makeyevugol'), imeni Kalinin and imeni Gayeviy (Artemugol'), the Yenakiyevskaya (Ordzhonikidzeugol') and others. The collective of Section No. 1 imeni A. G. Stakhanov at the Mine imeni 22th CPSU Congress, Stakhanovugol' Association has taken the initiative to expand competition among extraction section collectives under the slogan "The Five-Year Plan by the 50th Anniversary of the Stakhanovite Movement".

This initiative is supported by extraction brigade and section collectives in Voroshilovgrad Oblast. For example, the brigade of Hero of Socialist Labor I. V. Kozarenko from the Golubovskaya Mine, Stakhanovugol' Association plans to dig 7,500 tons of above-plan coal in 50 high pressure weeks.

Facemen at mines in Tsentral'niy Rayon in the Donbass are preparing to mark the famous jubilee with new labor achievements. The following well known facemen have reported already completing their personal five-year plans: N. M. Kholostykh, I. Ya. Golubyatnikov, V. F. Tereshenok, F. M. Kushch, S. M. Shkurko and others.

Miners in progressive collectives, assuming high obligations to worthily celebrate this jubilee, are calling upon workers at all mines to enter the high pressure duty dedicated to the 50th Anniversary of the Stakhanovite Movement.

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'UKRAINA' MINE CHARACTERIZED

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 pp 2-4

[Article by A.I. Veklichev, mine director: "Main Directions in the Development of Coal Extraction at the Ukraina Mine"]

[Text] The Ukraina Mine, Voroshilovgradugol' Association was put into operation in 1935, its planned annual capacity was 1.07 million tons. It is now working seams L-1-1, k-1n-7, k-5 and k-6, which have dangers of coal dust explosions. The working horizon is 410 m, the ventilation horizon, 290 m and a new one is being dug at 545 m. Seam L-1-1 is the main one (the mine will work out its reserves by the end of 1984). It has a simple structure, is 0.85 m thick and is thinning out. The immediate roof is sandy and clayey shale (3.4 - 10 m), the footwall is sandy shale (0.9 - 2.7 m). The wall rocks are unstable. The seam is worked in a panel arrangement, with pillars and by combined longwalls up-dip.

Seam k-7-1n has a simple structure, is 0.58 - 0.6 m thick, gently rolling, the angle of dip is 2 - 12°. The immediate roof is sandy shale of medium stability (5.25 - 8 m), the footwall is sandy shale (0.45 - 0.65 m). It is being developed by horizon, in a pillar method by longwalls going up-dip.

Seam k-6 is a double lense structure with a total thickness of 0.56 - 0.68 m, rolling bedding, and 6 - 14° dip angles. The seam has a danger of coal and gas blowouts at depths of 250 m. The immediate roof is sandy and clayey shale (1.65 - 10.6 m) and unstable; the footwall is sandy shale (0.90 m), tending to bulge. It is being developed by horizon, in a pillar method by longwalls going up dip.

Seam k-5 has a simple structure, 0.8 - 0.95 m thick, gently rolling, 5 - 9° dip angle. There is a danger of coal and gas blowouts. The immediate roof is sandy shale (0.85 - 1.3 m) average thickness, the lower part of the strata is unstable sandy and clayey shale (0.05 - 0.16 m) -- a false roof; the main roof is sandstone (4.7 m); the footwall is sandstone (2.3 - 2.7 m) and stable. It is worked in a panel, pillar system using longwalls going up dip.

Commercial reserves are mainly located in zones of geological disturbances, synclinal folds, in flooded strata, hindering their complete extraction. Developmental workings use the drill and blast method. Tunnel driving combines are not used because of the high rock strength (7 - 8 on the Protod'yakonov Scale). Rock is loaded by 1PNB-2, 1PNB-2b and 1PPN-5 machines. The workings are supported by AP type metal arches and sometimes by combined props, consisting of suspended (joint) canopies and wood posts.

Shot holes in soft rock are drilled by SER-19D hand held electric or EBGP-1 electro-pneumatic drills on moveable mounts; in hard rock PR-27s, PR-30s with pneumatic supports and BU-1 and BUR-2 drill units are used. Rock is hauled downward in inclined workings and horizontally by rail cars and upward by SP-63 scraper conveyors. To switch loaded cars for empties, horizontal workings are equipped with rail side tracks. Switching takes place in the upper receiving area of inclined workings, horizontally over a 10 - 15 m large cross section area. It has retarders and barriers remote controlled pneumatically. The scraper conveyor drive heads are located in special metal structures.

Developmental workings are locally ventilated. Two underground explosive storage magazines have been built to reduce outlays of time and manual labor for delivering explosives. The main developmental workings have electric locomotives to move cars, materials and equipment to the face. The mine has five operating working faces. Roof control at longwalls in seams L-1-1, k-6 and k-5 is by complete caving, and in k-7-1n by floating subsidence.

The collective at the Ukraina Mine has been diligently working for more than 10 years. The plan for the five-year plan's third year was completed on 14 November 1983: 992,600 tons of coal were shipped, including 192,600 above the plan. The daily planned extraction is 2,420 tons, while the actual figure is 2,590 tons; the average number of working faces operating is 5.2, the comprehensive mechanization level -- 36.3 percent and average daily loading per face -- 461 tons. The labor productivity plan was 110.9 percent fulfilled and the ash content of extracted coal reduced by 0.1 percent. The production cost per ton was reduced by 3.1 rubles through improved labor productivity. While the plan called for 8.6 km of opening and preparatory workings, 10.2 km were actually driven.

The collective has attained such results thanks to the precise organization of work, the rational use of labor time, economic use of materials, the introduction of new machines and equipment, progressive coal extraction technology, high labor and production discipline and proper planning and mining operations.

The mine is operating in difficult conditions. For a long time there were longwall collapses in L-1-1 due to thick sandstone in the roof. However, the collective handled these difficulties. It filled in rubble concrete along the entire longwall (following advancement) in three rows. This somewhat reduced the influence of main roof subsidence. Partial transitions from one longwall to another were a big hindrance in working out reserves in L-1. For example, the collective in Section 4 worked out the 5th south longwall and moved to the

4th south one (165 m long and a field of 110 m. This lasted 2.3 months, then they moved to the 2nd southwest longwall (110 x 180 m), where they worked 3 months, then to the 1st southwest (145 x 110 m), and finally to the 6th southwest (170 x 200 m) in which they will work 5 months. This creates additional difficulties resulting from the frequent disassembly and assembly of equipment. These are successfully handled by the MDO [Assembly - disassembly unit] led by P. V. Mel'nichuk.

The longwall worked by the section 4 collective is equipped with a 1K-101 narrow web combine, a SP-63 (SP-202) scraper conveyor, a "Sputnik" support and GSU-3 hydraulic posts installed under metal canopies. An LVD winch is used to install and remove conveyors and "Sputnik" supports. Metal supports are moved to the longwall by a scraper conveyor, which is the last thing to be disassembled and the first to be assembled.

In spite of the frequent moves from one longwall to another, the collective at section 4, led by A. D. Karpinskiy (brigade leader I. A. Tikhonyuk) is working successfully. Average daily extraction is 448 tons.

The mine started working k-6, a thin seam, to make up for coal extraction shortfalls. The section 1 collective, which had previously used a different coal extraction system, was not familiar with saws. A link from V. M. Vladovich's brigade was sent to section 8, which has long been using a UST-2m saw. As a result they rapidly mastered saw extraction. Average daily loading is now 308 tons and on some days reaches 504 tons from the 0.5 - 0.6 m thick seam.

There were also big difficulties with roof control. Rubble concrete [butokostry] was used to reduce the effect of the roof on the near face supports. This eliminated collapses and facilitated roof control.

As the mine is working out reserves at the 410 horizon, in 1979 it started construction of a new horizon at 545 m. Two inclines were driven from the operating horizon to the 545 m level and a lower receiving area built. Shaft 8 was sunk 736 m. At the 545 m horizon it is planned to work the seams: k-7-1v, k-7-1n, k-6 and k-5. UST-2m and SO-75 saw units will be used in the first three and a KD-70 complex in the fourth. The development will be with pillars (longwalls up dip). It is foreseen to use monorails to deliver materials and equipment, service the conveyor lines and take people down and back from wing workings. The new horizon will have a service life of 47 years and an annual production of 800,000 tons.

However, there are many shortcomings in the 545 m horizon construction plan. Ventilation problems have not been solved for the new horizon and simultaneously with ventilating the old 410 m one. The mine engineering service has had to do much extra work on this. A low pressure air removal system is used at the mine. This is the basis for calculating the necessary volumes of air. In order to reduce the aerodynamic resistance of workings, it would have been necessary to resupport them and increase cross sections over long distances. Instead of this we decided to drive a ventilation crosscut from shaft 5, which is now being sunk.

A water collector had to be built at 545 m prior to the introduction of a drainage unit at the 710 m horizon. The plan did not provide for a temporary garage. There were therefore difficulties in haulage along the 1.2 km horizontal working. A garage and charging room for 5ARV-2 locomotives has been built at the 545 m horizon and another one is being built for 12 2AM-8D electrics.

The mine proposed installing a 2LL-100 belt conveyor for moving people and coal to and from the 545 m horizon. It also intended to replace the functions of the new main shaft 8. The plan for the construction of horizon 545 and for freight and personnal haulage along the 410 - 545 incline requires the continuation of the 1LU-120 conveyor to move coal from the longwall of the new horizon and the installation of a 4DMK monorail. Instead of this, the mine proposed the extension of the 2LL-100 conveyor to move people in both directions and to haul coal. Preparatory work for the 2LL-100's installation is already under way.

Innovators and inventors are of great help in mine operations. The VOIR [All-Union Society of Rationalizers and Inventors] primary organization has 300 members. In 1983 it introduced 161 innovative proposals, one more than the planned figure. Their economic effect was 300,200 rubles, while the plan was 300,000. The most active innovators are G. D. Dolzhenko and A. G. Perevertnyuk, electricians in the VShT section. The innovative activities of Chief V. I. Bakunovts and Senior Mechanic on the automatic measuring station are well known. There is a group for the introduction of small scale mechanization and innovative proposals. It is made up of five electricians and one electric arc weldor and is headed by I. A. Bykadorov.

The most active VOIR members are combined into 10 creative brigades. One of them is headed by A. V. Myach. Together with L. M. Varesenko and A. N. Naumov, electricians, they have introduced an attachment for lifting fallen sections of KM-87 supports. The creative brigade led by Senior Mechanic V. G. Shklyar was awarded a prize from the VOIR associated council for a proposal to improve the safety of mine hoists and transport equipment.

All extraction sections met their targets and socialist obligations for 1983. The brigades led by V. D. Pavlovskiy, V. M. Vladovich and I. A. Tikhonyuk worked especially well. These collectives alone extracted 62,600 tons of above-plan coal.

The brigades led by N. S. Sviridov and N. M. Shlyakhov won first place in socialist competition among tunnel drivers in 1983. They were the first to meet their 1983 plans. Their above plan opening and preparatory workings were 177 and 90 meters respectively.

In order to mobilize the enterprise collective to fulfill plan targets and obligations, the mine administration and the trade union committee are working on conditions for socialist competition. These indicate the goals and tasks, the main and supplentary indicators used for summing up results. Organizational and technical measures have been taken to meet the obligations assumed. Socialist competition contracts have been concluded between brigades. The Ukraina Mine is competing with the Mine imeni Artem. The results are summed up every quarter.

Implementing the historic decisions of the 26th CPSU Congress, mine workers are supporting the deeds of the country's progressive collectives. Thus, the tunnel drivers brigades of N. S. Sviridov and N. M. Shlyakhov supported the initiative by the collective led by Hero of Socialist Labor A. Ya. Kolesnikov at the Molodogvareyskaya, Krasnodonugol' Association: "Not a Single Lagging Rank!", and assumed patronage over lagging brigades.

All mine units have spread the movement for improved production efficiency, strengthened labor, production and executive discipline, for discovering and completely using internal reserves and possibilities to increase coal extraction and tunnel driving.

Great attention is given to competition publicity. Socialist obligations are vividly displayed in well known places. Information on the course of competition is put on indicator boards every day, and at the start of the month, year and five-year plan. Socialist competition scores are summed up for monthly, quarterly and yearly work results. At the start of a month, information on the fulfillment of plans and socialist obligations presented to the production department is examined at joint sessions of the mine administration and trade union committee. These summations consider not only the fulfillment of techno-economic indicators, but the state of safety and of labor and production discipline. Victorious collectives are given banners, pennants, diplomas and money bonuses. They are also entered in the mine's Book of Labor Fame. Depending upon quarterly results, individual workers are given the title of best in the profession and awarded bonuses.

The Ukraina Mine has repeatedly won prize positions for results of socialist competition among enterprises in the Voroshilovgradugol' Association. All mine workers are now striving to keep the place attained and to beat the schedules for fulfilling 1984 plans and socialist obligations and the 11th Five-Year Plan in general.

The task for the immediate future is to put into operation the complex starting up in the new horizon: drive 2,180 m of developmental workings, do 4,870,000 rubles worth of capital construction, line the new shaft 8, deepen shaft 3, build a water collector at the south crosscut, equip the temporary garage at 545 m and the 2LL-100 belt conveyor for hauling coal from this horizon.

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COAL

UDC 622.26.8.13:658.387.001.86 "sh. Kremennaya"

KREMENNAYA MINE OPERATIONS DETAILED

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 pp 7-10

[Article by A. S. Borodin, mine director: "Labor Productivity Growth at the Kremennaya Mine"]

[Text] The Kremennaya Mine, Lisichanskugol' Association, was put into operaton in 1954. Its construction was planned by Yuzhgiproshakht [State Design Institute for Mines and Preparation Facilities]. Its annual capacity was 300,000 tons, or 1,000 tons daily. In 1968 the Kremennaya No. 1 and the Kremmenaya-Zapadnaya were combined into one production unit with an annual capacity of 500,000 tons of coal.

The mine field was opened up by two vertical central-double shafts 173 meters deep. Because the shafts are located at seam outcrops and mining operations are at the 770 and 838 m horizons, the transportation system along the inclined workings is complicated and requires the long inclines for delivering freight and moving personnel. The mine is in the extreme category with regard to methane emissions. There is danger of coal dust explosions and the spontaneous combustion of coal.

The mine is working seams L-1-1 and k-9-n. The former is 0.8 - 1.05 m thick, the immediate roof is clayey shale with poor stability (4 m thick), the main roof is sandstone (10 - 12 m thick), strong and flooded; the footwall is clayey shale with a tendency to bulge. Seam k-8-n has a complex structure and a 1.3 - 1.9 m total thickness; the roof is weak clayey shale and the footwall strong sandstone. The dip angle is 18 - 25°.

The working system is with long pillars, working up the dip, retreating from stoping section boundaries. The reserves in a level are worked by pillar-free methods, ventilation drifts are driven cross-wise to the former conveyor drift in the upper longwall.

The pillars are robbed from an incline driven from the 9th west field drift to the 838 m horizon. From an auxiliary incline a crosscut is driven to seam L-1-1, then to seams L-1-1 and k-8-n; a conveyor and ventilation drift is driven east and west to the boundary of the stoping section. It is 500 - 1,000 m long. Seam strikes are driven with the help of drilling and blasting. The working cross section is 10.4 m^2 clearance, the supports are metal arches,

rock is loaded by 1PNB-2 machines, coal is moved by 1LT-80 or 1L-80 conveyors, 40 - 50 meter SR-70 scraper conveyors are installed at faces. Four working faces are constantly in operation: 1 in seam L-1-1 and 3 in seam k-8-n. Two longwalls are equipped with 1K-101 narrow web combines and individual supports, and two others with mechanized complexes In west longwall 103, seam k-8-n there is a MK-75 mechanized complex, a 1GSh-68 combine a SUMK-75 conveyor, and in west longwall 104, a 1MKM mechanized complex.

A 1L-80 conveyor with a 160 m^3 bunker is used to move coal from working faces along seam strikes, later a 1LU-100 conveyor moves it up the incline to the loading point at the 9th west field strike, where it is loaded into 2 ton rail cars and pulled by AM-8D electric locomotives to the hoisting horizon at 683 m. KRU-260 conveyors move it up an incline from horizons 683 and 838. The coal and rock is hauled to a bunker at the skip shaft.

During 1980-1981 the mine did not reach its established production capacity. The collective has been working diligently since 1982 and is improving its main techno-economic indicators. This was achieved through the elimination of factors delaying increased coal extraction, in particular, poor quality and short working face lines, the use of low productivity stoping equipment; failure to supply working and development faces with the essential amounts of air (complex ventilation layouts, the length of ventilation workings); multi-stage transportation and the great length of inclined workings used to deliver materials, equipment and personnel, and the low throughput capacity of workings with terminal hoists.

The mine's successful operation was hindered by the procedure for working two seams 33 m apart. One was developed level by level and worked by a longwall starting at seam L-1-1. A conveyor drift was driven from an intermediate crosscut along seam k-8-n the entire length of the stoping section. From this drift 200 - 250 m from the section boundary a crosscut was driven to seam L-1-1 and a longwall prepared. After L-1-1 was extracted, extraction operations began on seam k-8-n, with a lag of 200 - 250 m. As the conditions for working seam L-1-1 were more complicated, longwall advance did not exceed 20 - 25 m/month, while the longwall in seam k-8-n had better conditions and moved faster, undercutting seam L-1-1. We had to artificially delay the longwall in k-8-n, or stop work in L-1-1 and recut the longwall, leaving large pillars.

Over several years different engineering solutions were made to increase the advance rate of the longwall in seam L-1-1. At three times a Donbass complex was introduced. The longwall was cut at 180, 150 and 125 m lengths, but positive results were not obtained. The immediate roof of seam L-1-1 is clayey shale (4 - 5 m), above it lies strong, flooded sandstone 10 - 12 m thick. If the longwall height is 10 -15 m, the main roof is weakened, the mechanized supports are rigidly seated and the roof at the face is disturbed, with water flowing from the sandstone to the working space. In order to improve the roof use was made of ancher bolts, sandstone torpedoing, main roof rock retention with the help of a rubble concrete wall, but we did not succeed in increasing longwall extraction from seam L-1-1.

Up until 1981 coal was extracted from seam k-8-n using Donbass-1G combines with portable knock-down SK-38 conveyors, roof control was by partial caving and partial filling. As a result of analyzing mine operations over the past five years, it was decided to use highly productive equipment in developing and working the initial reserves of seam k-8-n. Mining operations along seam k-8-n will weaken the sandstone located above seam L-1-1 and drain water, making it possible in 4 - 5 years to work seam L-1-1 with KM-103 mechanized complexes or other more improved equipment.

In January 1982 the 125 m long 103 west longwall was put to work in seam k-8-n. It has a dip angle of 18 - 20°, is 1.9 m thick, a 900 m stoping field, two 1L-80 conveyors are mounted in the conveyor drift and a SP-63 at the longwall. Coal moves from the working face by conveyors to a 160 m^3 bunker. The longwall is equipped with an MK-75, a 1GSh-68 combine and a SUMK-75 conveyor. Its introduction sharply increased extraction. Average daily loading per longwall in 1982 was 458 tons, in January 1983 was already 709 tons, and in some faces reached 1,000 tons or more. The use of the 1GSh-68 combine permitted the elimination of 70 percent of the manual labor for nitching. Three meter long nitches were prepared for the upper and lower sections. The stoping scheme is one sided, from the bottom up the coal is excavated to a depth of 0.5 m and from the top down the longwall is cleaned and the conveyor advanced, following the combine. The wall is worked by the section No. 3 collective headed by I. P. Ruban. An experienced miner, V. I. Kaslanov, leads the comprehensive brigade. All face workers and electricians are trained to run the mechanized complexes. The work pattern for the section, and the mine as a whole, is three working shifts and one repair and development shift.

In the repair shift, a specialized link of men with advanced skills and experience repair machinery, adjust SP-63 conveyors in drifts, replace hoses, control panels and props. The repair link is led by A. P. Boreyko. The link covers 12 working faces.

The working program for the stoping section in the 103 west longwall in seam k-8-n intended to go to the conveyor incline in horizon 838, halt at the wal and then cut and equip a new longwall in the east side of the incline. The mine engineering service proposed an alternative: working reserves without halting the longwall up to the eastern boundry of the stoping field and without disassembly. With this variant, however, it is necessary to replace mechanized supports, as seam thickness from east to west declines from 1.9 to 1.4 m.

P. P. Yuvchenko, the mine's Chief Technologist, and workers in the technical department proposed replacing MK-75 section columns with smaller ones without halting the longwall. Section leaders and brigade councils worked out a detailed process for changing columns. The method proposed for replacing them without halting work and without reducing longwall loads is giving a good economic effect.

In 1982 another longwall with an 1MKM was introduced in seam k-8-n. In 1983, the section No. 4 collective (leader I. K. Ostapets and brigade leader V. N. Gar'kavets) produced over 12,200 tons of above-plan coal and by 8 December

1983 completed fulfillment of the annual coal extraction plan. The communist labor collective in section No. 2, lead by V. A. Prikhodchenko and A. A. Strashniy worked in difficult conditions. However, in spite of the complicated geological conditions of seam L-1-1, this collective was able to meet its annual plan by 17 December 1983. The great length and gas abundance hindered ventilation. Therefore the ventilation layout was changed and an airshaft drilled to the 838 m horizon. This permitted supplying development and working faces with the necessary air and creating normal temperatures. This helped increase longwall loadings.

Also, measures were taken to reduce longwall idle time to to delays in spotting empties at loading points. Conveyors deliver coal from working faces to a 160 m^3 bunker, then it goes by 1LU-100 conveyor to a loading point at the 9th west field drift, with a siding for 80 cars.

Considerable attention is given to production mechanization and automation. L. A. Dranev, the senior mechanic for automation, has invested much labor in this. All conveyor lines are automated, non-ventilated blast heaters used, the central underground substation transferred to remote control, with the control panel at the mine dispatchers.

There is no lagging in problems of improving labor discipline, selecting and assigning cadre. For a long time section No. 5 did not fulfill the extraction plan and 1MKM-1 loading was less than planned. It was decided to strengthen collective leadership: I. S. Antonov, who had worked on a MK-75 in the link of V. I. Kaslanov's brigade, was designated as leader. I. S. Antonov found contact with the collective and mobilized it to fulfill the plan. In 1983 the mine drove 7.6 km of workings, including 6.5 km of opening and development ones. Good results were obtained by the brigades led by A. I. Pikulin, N. I. Zagoruyko and I. I. Zema . The mine still has unutilized reserves, in particular this means reductions in machinery breakdowns. The main reasons for idle time due to breakdowns is slow delivery of spare parts and equipment; design defects in some parts, assemblies and machines supplied to the mine, and an unregulated supply system. For example, a 1GSh-68 combine with a pully feed system is operating in the 103rd west longwall of seam k-8-n. A 1GSh-68 combine with a direct feed system, which is not appropriate to mining geological conditions was sent to replace it. We receive 1K-101 combines with round directed conveyors, but the SP-63 conveyor is flat. The machine shop rebuilds them, requiring additional outlays of time and material resources. It is necessary to standardize machinery for the coal industry.

Thanks to the selfless work of progressive collectives and the introduction of new equipment at working and development faces, the mine had stable operations and successes in 1983. It fulfilled the annual coal extraction plan ahead of schedule, on 12 December, and on 22 December 1983 completed the third year plan. Compared to 1983 extraction grew by 56,000 tons. The labor productivity plan was 104.4 percent fulfilled and grew 7.6 percent compared to 1982. Above plan sold output was 3.2 million rubles, 2.9 million rubles of allocated capital investments were used and the development driving plan was 103.4. percent fulfilled.

In 1984 more difficult tasks were posed. A number of programs were developed for their solution: "Labor", "Production Cost", "Mine Development", "Reduction of Mine Workings in Unsatisfactory Condition" and "Quality".

Labor productivity growth is mainly influenced by: increased loadings at mine and working face; improved mechanization of rock and coal loading; decline in percentage of development workings. Therefore the "Labor" program foresees improved comprehensive mechanization of mucking work and the introduction of new longwalls with mechanized complexes. While in 1983 61 percent of faces were so mechanized, the program calls for increasing this to 75 percent.

In 1984 we must introduce three longwalls in seam k-8-n, including one with a 1MKM. Also, to create a reserve front for extraction, it is intended to prepare coal reserves in the eastern wing of the mine, along seam L-1-1. This requires a large amount of development driving, deepening a pipe and cable shaft and drive the 10th eastern field drift. To improve the mechanization level at development operations, 2PNB-2 loaders will be used in driving field inclines to horizon 988 m, and a GPK combine in conveyor drifts along k-8-n.

We foresee improving production and labor organization through reductions in intrashift time losses at working and development faces, improved labor organization and the use of the coefficient of labor participation (KTU). A statute has been worked out for using this coefficient in brigades. At each week's end in extraction brigades and each month's end in development ones there is a session of the brigade council, which sums up work results and allocates wages using the KTU. Brigade contracts have been introduced at the brigades of A. I. Pikulin and I. I. Zema , which will drive inclines to the 988 m horizon.

To reduce time losses due to breakdown it is essential to strengthen machinery and individual worker's equipment, giving personal responsibility for planned repair and inspection quality. The "Production Cost" program outlines a 0.5 percent reduction per ton of coal through timber savings (50 m^3), explosives (72 tons), electrical energy (435,000 kWh), fuel (93 tons) and through the repeated use of arch supports, rails, pipe and cable.

We intend to close down workings which are in unsatisfactory condition. This will be through driving new one and increasing their inter-repair service life. This will mean larger cross sections, higher prop density, the location of workings in relieved zones or cross wise to worked out spaces.

Each point in the program designates a responsible worker in the mine apparatus and engineering and technical personnel to sections. The deputy chief engineer for production is responsible for increased loadings; the chief technologist for improved technology, the chief mechanic for reducing time losses from machinery breakdowns, etc.

The mine has enhanced the responsibility of mine supervisors and links for meeting shift targets. On leaving the mine, each supervisor gives a report on work done during the shift and is responsible for plan fulfillment and

discipline. Once a week there is a session of the production commission and supervisor work results are tallied; shift leaders' work is tallied monthly and so is that of extraction and tunnel driving brigades. The victors are solemnly awarded Challenge Red Banners and money bonuses.

The party organization and administration are giving great attention to improving workers' social and service conditions. The mine area is being landscaped, general improvements made, interior improvements being made in the administration building, the dressing room in the administrative and service combinat equipped, the bathrooms improved, the machine shop building expanded and mechanized loading and unloading begun at the warehouse.

On 9 February 1984 there was a school of progressive experience, dedicated to the work of the Kremennaya mine manager to increase labor productivity. The exercises were organized and prepared by a service of Lisichanskugol' and the UkSSR Ministry of the Coal Industry's TsBNTI [Expansion unknown]. On 22 February 1983 the rayon party committee conducted a general Open Letter Day.

In 1984 the collective assumed obligations to beat the schedule for meeting the target, extracting 15,000 tons above the plan and completing the labor productivity plan by 101 percent. This is due to improvements in coal extraction technology, its efficient use, the spread of progressive experience and the reduction of time losses. In the First Quarter of 1984 the Kremmenaya collective fulfilled the extraction plan by 106 percent (producing more than 8,100 tons above plan) and the labor productivity plan by 104.1 percent. The development working plan was 101.4 percent fulfilled and production costs per ton reduced 2.63 rubles below plan.

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COAL

NEW MINING EQUIPMENT

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 p 16

[Article: "New Mining Equipment"]

[Text] Donatvomatgormash [Donets Automatic Mining Machinery Plant] has developed a test stand for studying automatic hydraulic drives for mucking combine feeds. It consists of a hydraulic feed unit from a 1GSh-68 combine, a load regulator, load device and an electronic movement modeler (EMD). The load device used a electromagnetic clutch and a VSP-1 sliding drive, the excitation current of which is provided by a magentic amplifier. A VAO 82-4 asynchronic motor runs a NP 120 pump. The EMD includes a model of the coal seam breakage process, combine movement and the feed direction for the asynchronous cutting drive.

The stand's measurement and recording unit will simultaneously describe 18 combine -- face coordinate systems.

VNIIgidrougol' [All Union Scientific Research Institute for Hydraulic Mining] has developed an explosion proof phase impulse distance finder with feedback from the face to the hydromonitor during hydraulic breaking. It has receiving and transmitting units and cases.

The case is cylindrical, with a ring shaped cover and protective fasteners. The front has an explosion proof aperture for optical radiation. The transmitter uses a solid state 15 W laser. A photomultiplier working as a frequency transformer serves as the photo detecter.

The low frequency envelope impulse signal carries the information on the distance measured. An instrument measures the profile of the wall, showing the range of distances measured is 1 - 15 m, the linear resolution not less than 30 cm and the allowable angle from the surface is 70°. Such parameters are sufficient for feedback from the face to the hydromonitor.

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NEW METHOD FOR DETERMINING AVERAGE MINE DEPTH PROPOSED

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 pp 38-39

[Article by I. A. Levchenko, engineer, Ukrainian Affiliate, VNIMI [All Union Scientific Research Institute for Mining Geomechanics and Mine Surveying] and V. I. Filatov, engineer, UkSSR Minugleprom: "Determining the Average Depth of Coal Field Development"]

[Text] The large interval spacing in mining depth requires a methodology which will more completely and accurately reflect the average depth of work in fields and basins and the average annual drop (gradient) in order to determine the intensiveness of field development. The following is annually determined for UkSSR mines: average depth of development or extraction operations, H_{ae}, maximum depth of extraction work H_{maxe} and development work H_{maxd}. Mines are grouped by depth of working within a field or association. Average depth, H_{ae} for mines, associations and fields is to be computed differentially (with the breakdown of fields into 50 m vertical intervals) using the equation:

$$H_{ae} = \Sigma h_{ei} E_i / E_i$$

Where h_{ei} is the average depth of extraction work by interval (determined as the weighted average depth of hoisting drifts in a given interval), m

E_i is extraction from coal strata in working face within interval, 1,000 tons

For pillar systems extracting coal up or down dip by longwall this includes extraction from the seam worked within the invervals during the period considered. Depth is the average for this interval. The maximum depth of extraction work in a mine or association is determined by the deepest hoisting drift for an operating longwall, and that of development work by the deepest working. The percentage by depth for field, association or basin is found for the depth distribution of extraction. For the annual depth gradient of workings it is possible to carry out a differential calculation of mining geological conditions for mines in a region when planning indicators for maintaining workings, operating losses of coal and the possibilities of resuming operations, etc.

Table 1. Depth of Extraction and Development Workings

Depth of Mining	Mine A		Mine B		Association	
	h_{ei} m	E_i 1,000	h_{ei} m	E_i 1,000	h_{ei}, m	D_i 1,000
100—150	—	—	131	120	131	120
150—200	—	—	183	185	183	185
200—250	—	—	234	520	234	520
. . .	. . .	. . .	. . .	. . .	. . .	. . .
450—500	462	300	—	—	462	300
500—550	541	240	—	—	541	240
550—600	574	410	—	—	574	410
600—650	612	10	—	—	612	10
H_{maxe}	645	—	234	—	645	—
H_{maxd}	1020	—	317	—	1020	—

Table 2. Maximum Depth of Extraction and Development Workings

Association	1982 г.			1983 г.			$\Delta\bar{H}_{ae}$ m
	H_{ae} m	H_{maxe} m	H_{maxd} m	H_{ae} m	H_{maxe} m	H_{maxd} m	
A	588	1030	1057	589	1070	1190	+1
Б	425	886	986	482	986	986	+57
В	565	605	610	556	865	865	—9
Ministry	469	1192	1209	476	1180	1209	+7
Basin, field	487	1192	1209	503	1180	1209	+16

Table 3. Depth Distribution

Depth of Mining	Extraction, 1,000 t		Annual changes 1,000 t
	1982 г.	1983 г.	
0—100	5501	5317	—184
. . .	. . .	. . .	. . .
150—200	4038	4013	—25
. . .	. . .	. . .	. . .
1000—1100	1004	1484	+480
1100—1200	97	194	+97
Association	75 224	76 335	+1111
Basin	160 194	158 799	—1395
Ministry	181 841	184 880	+3039

The following procedure and formulas might be suggested for ministries and associations to calculate working depth for fields and basins. Data for determining average depth and maximum depth of extraction and development for the report period are given in Table 1. (Mines A and B are used as examples.).

Based on average mine depth, similar calculations are made for fields, basins and the ministry. The maximum depth of extraction and development workings is given in Table 2. (where ΔH_{ae} -- changes in average depth during year), and the distribution of extraction by depth in Table 3.

Mine surveying measurements of workings are the basis of annual extraction from coal strata. Using this method for calculating average depth within a mine field we obtain additional information: the depth interval distribution of extraction and its variation over time, the maximum depth of and changes in extraction and development workings. This is essential to describing mine conditions.

Mining and engineering geological conditions are predicted for each mine on the basis of data from geological exploration and statistical analysis of seam development. These data also determine quantitative and qualitative parameters of changes in basic factors linked to changes in working depth: increased rock pressure, gas. danger of blow-outs, temperature, water, etc.

Analyzing and drawing inferences from data for individual mines makes it possible to describe the qualitative characteristics of multifactor relationships in field conditions. In the final account these are expressed through the depth of operations. Consequently, the depth of operations is the basic and comprehensive parameter to which one can relate data on a field's mining and engineering geological conditions. This permits more accurate solutions to problems of predicting field development, mine design, current planning for locations, the selection of measures to protect workings and surface facilities, labor intensiveness, norms for material consumption and coal loss and the determination of capital outlays.

It is recommended to use this method for determining average depth within the boundaries of fields and administrative associations. It is more advisable to calculate the average depth of workings within these boundaries by breaking mine fields into depth intervals. The ratio of extraction within a given interval will give a more objective and differentiated description of mining engineering conditons and mine operation indicators.

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COAL

NEW MINING EQUIPMENT DESRIBED

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 p 43

[Article: "New Mining Equipment"]

[Text] Pechorniiproyekt [Pechora Planning and Design Institute] has developed and tested the TEV-2 electric overhead hoist for mines. It is intended for loading, unloading and moving on a horizontal direction monorail in mine workings where there is a danger from gas and dust. It has lift and movement units mounted in a common welded frame. The lift unit has a ED-ZK electric motor with a reducer from a SHV-220 mine auxiliary winch, a cam-disk clutch, a two thread worm gear, a worm gear wheel and shaft with cluster gear, a load chain and hook. The worm gear and brake are in an oil bath.

Like the lift unit, the movement unit used a ED-DK with reducer, support and stabilization rollers, a pulley cable and springs. The conrol and power cables are suspended from a steel cable stretching along the monorail.

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COAL

BRIGADE LEADER COMPLAINS OF POOR SUPPLY

Baku VYSHKA in Russian 12 May 84 p 2

[Article by V.Kurdyumov, brigade leader, Baku Mobile SSMU [Special construction-installation administration],Soyuzshakhtospetspromstroy [All Union Special Mine Construction Trust]: "The General Contractor's Indifference"]

[Text] By 1 June the Baku Administration of Soyuzshakhtospetspromstroy should have turned over to the start-up complex 2.5 kilometers of production zone collector tunnel from the Street of People's Friendship to the ZhBI-4 plant, connecting 8 mines. This tunnel has already been dug and received secondary finishing. The brigades led by N. Ivanov, P. Galyaev and myself are working here, but, alas, have not attained good labor productivity. The problem is that we had the rights of subcontractors in digging and finishing the tunnel. Trust No. 2, the general contractor, signed a contract to supply us with construction materials. However, the trust has badly fulfilled its obligations, especially in supplying ready-mix concrete, ferroconcrete items and compressors.

Frankly, the general contractor's indifference to the project's fate is the reason for the breakdowns in tunnel driving work and in the start-up complex as a whole.

Unfortunately the general contractor's position has not improved even now, when a new introduction deadline has been planned and we only have a small amount of finishing left, hardly more than 100,000 rubles.

In order to prepar the tunnel collector for acceptance by the working commission, we need to cover eight shafts. This requires ribbed ferroconcrete plates and ready-mix concrete from Trust No. 2. At project staff meetings, trust manager G. Kasumov has repeatedly assured us that the tunnel drivers would be completely supplied with these materials. However, these words are not supported by deeds: In April we did not receive half the plates and 60 cubic meters of ready-mix concrete.

Back at the beginning of the year we asked the concrete plant about the reason for the delivery shortfalls. We found out that the concrete workers did not have enough cement or gravel, which they receive by rail from the station at Gousany. We started helping them, becoming concerned about cement and gravel deliveries. But soon we were convinced that even with materials, there were stoppages at the plant. There is weak discipline and the general contractor is not taking the measures needed to put things in order. We are uneasy about this approach, or more accurately, this indifference. We are disturbed by the fate of plan fulfillment at the start-up complex and ask that some order be brought into supporting the normal work of brigades in our administration.

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BETTER PREPARATION, CHECKING OF MOSCOW COAL URGED

Moscow EKONOMICHESKAYA GAZETA in Russian No 26, Jun 84 p 18

[Article by V. Zheleztsov, chairman, Tulenergo People's Control Group and S.Shcheglov, engineer: "But the Costs are High"]

[Text] Many electric power stations in the Central Economic Region use Moscow coal for fuel. Its extraction is becoming more costly, due to the deposit's depletion. In addition, its calorific value is declining, making it necessary to consume large amounts of it. Naturally, electric stations bear sizable losses.

According to data from mechanized control, in 13 years the average ash content (dry weight) of Moscow coal increased from 37 to 48.5 percent. Just what are Moscow Basin coal miners doing in this regard?

Well equipped coal preparation facilities have been built and are operating at large modern underground and surface mines. With the start up, in the next couple of years, of two more large undergound mines -- the Nikulinskaya and Afanas'yefskaya, the quantity of prepared coal will increase to half of all extraction. Miners are also taking measures to see that unprepared coal has minimal rock content when it arrives at power stations.

All the same, these measures are still not giving the desired effect. Thus, according to data from the Novomoskovskugol' and Tulaugol' Production Associations, during the First Quarter of this year the ash content of shipped coal was 36.5 percent. Coal which was processed at the facilities of the Vladimovskaya Mine had 44.8 percent ash content and that from the Bel'kovskaya Mine -- 44.7 percent.

Studies show that additional outlays for the combustion of reduced quality fuel are 7.8 percent of the cost of Moscow coal for each 1 percent increase in ash content. For the three large power stations in Tulaenergo overexpenditures are more than 65 million rubles annually.

The price list wholesale price for solid fuel introduced in 1982 sets a price of 10.95 rubles per ton of run-of-mine Moscow coal with 36.4 percent ash content. There is a 2.5 percent markup or reduction for each 1 percent decline or increase in ash content. Although reductions are considered to compensate

for reduced calorific value, they by no means compensate for the considerable losses which power stations bear from using such fuel.

They are increasing even more due to imperfections in the existing system for estimating fuel quality. The coal supplier indicates the ash content of each batch shipped on the so-called quality certificates, which are the basis for payments for production costs. True, GOST 1137-64 [State Standard] gives power producers the right to monitor the quality of arriving fuel. In practice, however, it turns out that large power stations, receiving hundreds of rail cars full of coal daily, have the technical means to monitor the quality of only some of the fuel.

Under these conditions, suppliers often raise coal quality the certificates. Thus, last year they showed a 37.9 percent average estimated ash content, while power producers' data showed 48.5 percent. This cost the Tulaenergo system another 29 million rubles.

The average annual cost of Moscow coal (calculated as standard fuel with a heating value of 7,000 kilocalories, plus delivery costs) was 38.87 rubles. The per ton of standard fuel cost of long-hauled Kuznetsk coal was 25.07 rubles, and that of Ekibastuz -- 19.20 rubles. So, Moscow coal, the use of which brings sizable losses to power producers, turns out to be the most expensive type of fuel.

The electric power stations have become money losing enterprises. The production costs of the electrical energy they produce exceeds by 1.5 fold the cost of energy from long-hauled coal. Due to the use of low quality fuel, the collectives of stations working in the most difficult conditions are in even worse financial shape.

What, in our opinion, are the ways to solve this problem?

Above all, the price of Moscow coal should be reexamined to bring it into correspondence with its actual heat value and additional costs for its use.

It is essential to accelerate the preparation of low quality coals. According to studies by the All-Union Heat Engineering Institute, outlays for this would be covered by the elimination, with one exception, of its price reductions. Consequently, this would liquidate considerable national economic losses from the direct use of low quality coal and simultaneously improve the environment.

Furthermore, conditions should be created for the objective evaluation of coal quality. Fuel quality could be monitored directly at power stations by the installation of mechanized samplers. It will be possible to suppliers and consumers to make estimates from one daily sample. This would reduce the work of a large number of samplers, laboratory workers, engineering and technical personnel and accounting workers. Customers are freed from the need to exercise incoming (and repeated) control over arriving fuel. This would also reduce rail car idle time.

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SYNOPSES OF ARTICLES IN UGOL' UKRAINY, JUNE 1984

Kiev UGOL' UKRAINY in Russian No 6, Jun 84 p 48

UDC 622.012.24.002.2.003.13

EFFICIENCY OF USING HYDRAULIC TECHNOLOGY IN THE DONBASS

[Synopsis of article by B. V. Rad'ko and I. M. Shenderovich, pp 12-13]

[Text] The economic efficiency of the hydraulic underground mines, Krasnoarmeyskaya and Pioner, compared to similar mines (The former have higher labor productivity and lower extraction costs).

UDC 622.815:622.274

IMPROVING THE DEVELOPMENT OF STEEPLY DIPPING BLOW-OUT PRONE SEAMS

[Synopsis of article by N. M. Tkachenko and A. P. Tkachenko, pp 13-14]

[Text] A system for working a single blow-out prone seam with parameters including the influence of worked out horizon pressure on degassing the seam along the dip. Advantages of suggested system. 1 illustration.

UDC 622.275.088.8

CONTROL OF ROCK MASS CONDITIONS

[Synopsis of article by A. F. Papyrin and K. K. Sofiyskiy, pp 14-15]

[Text] Research on the influence of cyclic loading and elastic waves on the strain and deformation state of the near-face part of a coal seam using systems of vibrators based on hydraulic supports.

UDC 54-4:622.023.23

CHEMICAL SOLUTIONS FOR REDUCING ROCK STRENGTH

[Synopsis of article by N. I. Shcherbak, pp 15-16]

[Text] Features of new chemical solutions for reducing rock strength. Their efficiency, determined in laboratories and mine conditions. 2 tables, 1 reference.

UC 622.62 -- 52:338

ECONOMIC EFFICIENCY OF THE USE OF 'PRIZ-M' LOAD REGULATORS

[Synopsis of article by N. A. Mishchenko, A. Ye. Solonova and P. Ye. Pasynkov, pp 17-18]

[Text] Advantages of PRIZ-M load regulators compared to series produced PRIZ. The efficiency of automatic regulation of drilling speed and the use of a new drilling method. 1 table, 1 illustration.

UDC 622.6. "313" 518.3

USE OF NOMOGRAMS TO ANALYZE AND FORECAST LABOR INTENSIVENESS OF UNDERGROUND TRANSPORTATION

[Synopsis of article by S. N. Larin, G. G. Furletova and I. A. Furletov, pp 18-19]

[Text] Mathematical model of labor intensiveness of underground transportation in Vorkutaugol' Association mines, nomogram for determining this. 1 illustration.

UDC 622.26:65.011.54

FEATURES OF WORK MECHANIZATION IN DRIVING WORKINGS

[Synopsis of article by I. N. Bezmen and V. G. Kilimnik, pp 19-21]

[Text] Reasons delaying the growth of techno-economic indicators in driving. Delineation of four zones for driving workings, requirements for temporary protective supports and mechanization for tunnel driving combines or drill units. 1 reference.

UDC 622.274:621.3

IMPROVEMENTS IN ELECTRICAL EQUIPMENT AND PANEL UNIT CONTROL SYSTEMS

[Synopsis of article by Z. M. Rabinovich, B. Ya. Starikov and I. S. Kibrik, pp 21-22]

[Text] Analysis of electrical equipment and control systems of shield units and was of improving them.

UDC 622.273.217.5:622.878

NOISE REDUCTION IN PNEUMATIC FILLING

[Synopsis of article by Yu. S. Makarevich, A. F. Nikolayev and V. A. Vol'skiy, pp 22-23]

[Text] Results of research on noise characteristics of DZM2 two chamber pneumatic filling machine and methods of reducing noise level. Recommendations. 2 illustrations.

UDC 622.489.019.3

RELIABILITY OF NKGK-11D HERMETICALLY SEALED BATTERIES FOR MINE LOUDSPEAKER

[Synopsis of article by A. Yu. Gorodetskiy, A. V. Zhadan and A. S. Lutsenko, pp 24-25]

[Text] Determination of battery charging time under various temperatures and of increased operational reliablity. 2 illustrations.

UDC 622.232.83.054.001.4

BITS FOR TUNNEL DRIVING COMBINES

[Synopsis of article by A. V. Loktionov, pp 25-27]

[Text] Testing, research, evaluation and comparison of bit units of tunnel driving combine equipped with IT-2S and PKS-1 tangential cutters. Relative energy consumption. 1 illustration.

UDC 62 - 783.31.001.2.622.232

RIGID BARRIER FOR INCLINED WORKINGS

[Synopsis of article by A. F. Dubich and V. A. Kulibaba, pp 27-28]

[Text] Description and operating principles of a rigid barrier for inclined workings developed by NPO Uglemekhanizatsiya. 1 illustration.

UDC 622.673.14/.6.001.5

A RATIONAL METHOD FOR SUSPENDING CABLES OF MULTICABLE LIFT UNITS

[Synopsis of article by V. I. Dvornikov and V. V. Makhnya, pp 28-30]

[Text] Based on solutions to differential equations describing the tension--deformation state of a cable during winding through a friction pulley, a rational method is found for suspending cable from a freely rotating ring. 1 table, 2 illustrations.

UDC 621.316.91:622.23.05

PROTECTING MINING MACHINERY DRIVES FROM OVERLOADING

[Synopsis of article by M. I. Khrisanov, M. A. Gonchar and L. P. Ivkin, p 30]

[Text] Theoretical basis and description of device for overload protection of machinery drives. 1 illustration, 2 references.

UDC 622.232.72.001.5

ON THE STABILITY OF MUCKING COMBINES

[Synopsis of article by A. A. Yakobson, p 31]

[Text] Methods for solving design problems concerning mucking combine stability. A new sector standard for calculating stability. 1 reference.

UDC 622.411.332:53.981.4

ON THE INFLUENCE OF MINE PRESSURE ON THE METHANE ABSORPTION CAPABILITY OF COAL

[Synopsis of article by V. T. Vodolazskiy, p 32]

[Text] The probable reduction of methane absorption in samples of Donbass coal, depending upon depth, all other conditions unchanged. The empirical dependence of relative changes in absorption upon depth through a metamorphic series. 1 table.

UDC 622.812.814:622.244.5

FEATURES OF ROCK MASS BREAKAGE DURING COAL AND GAS BLOW-OUTS

[Synopsis of article by I. S. Fridman, pp 33-34]

[Text] Study of laminar breakage of rock mass during blow-outs. Methodology for the quantitative estimation of stoping conditions' influence upon blow-out danger in specific mining geological and engineering conditions. 2 references.

UDC 622.693.4:351.823.3

PROTECTING NATURE DURING HYDROMECHANIZATION IN MINES

[Synopsis of article by I. I. Dudenko and L. D. Kovtunekno, p 35]

[Text] The hydromechanization of filling work, using mine rock, spoil bank rock, slag and ash from TES, possibility of entironmental protection. Completely automated stoping by hydromechanization and ratonal use of natural resources. 1 illustration.

UDC 622.26.023.67

DETERMINATION OF SAFE DEPTH FOR DRIVING WORKINGS UNDER QUICKSAND

[Synopsis of article by I. Ye. Golovchanskiy, pp 36-37]

[Text] Experience in working Western Donbass seams under quicksand. Determination of safe depth for driving preparatory workings under quicksand. Recommendations. 2 illustrations.

UDC 550.8:622.01

DETERMINING THE BORDER ZONES OF SUITABLE COAL

[Synopsis of article by A. Ya. Permyakov, pp 37-38]

[Text]Proposals for determining the border zone of suitable coal resulting from special research. 1 table.

UDC 622.272.(24:181)001.24

DETERMINING THE AVERAGE DEPTH OF COAL FIELD DEVELOPMENT

[Synopsis of article by I. A. Levchenko and V. I. Filatov, p 38-39

[Text] Methodology for determining average depth of development and workings within boundaries of mine field, deposit and basin. 3 tables.

UDC 622.765:622.794.4 "TsOF Sukhodol'skaya"

OPERATION OF DRIER DRUM MADE FROM ALLOY STEEL

[Synopsis of article by N. I. Bondarenko, p 40]

[Text] Results of operating alloy steel drier drum to dry flotation concentrate at TsOF [Central Beneficiation Factory] Sukhodol'skaya. 1 illustration.

UDC 622.831.322

PATTERNS OF COAL CRUSHING

[Synopsis of article by A. A. Borisenko, pp 40-41]

[Text] Basic patterns of coal crushing, found experimentally. Method of determining energy intensiveness of breaking. 1 illustration.

UDC 622.223.3:681.3.06

ALGORITHM FOR SELECTION OF FLOWSHEET FOR CONSTRUCTION OF NEW HORIZONS

[Synopsis of article by L. A. Noskov and V. S. Bondar'. pp 42-43]

[Text] Flow chart of algorithm for selecting flowsheet for construction of new horizons at mines. 1 illustration.

UDC 622.33.002 "Komsomolets Donbass"

USE OF EFFICIENT MATERIALS IN TOWER HEADWORKS

[Synopsis of article by N. A. Shabek, p 43]

[Text] Composition of slag-pumice concrete, its advantages over heavy concrete. Use in tower headworks at Komsomolets Donbass Mine. 1 table.

11574

GOSPLAN DEPUTY CHAIRMAN OUTLINES CONSERVATION PROGRAM

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 5, May 84 (signed to press 4 May 84) pp 2-5

[Article by Arkadiy Lalayants, deputy chairman, USSR Gosplan: "Important Components of Intensification"]

[Text] In the present stage--the stage of the improvement of developed socialism--the Soviet people are working on one of the most important socioeconomic tasks formulated by the Communist Party: the conversion of the national economy to the path of intensification. Since it is a complicated problem that involves many different types of plans, it requires the implementation of a complex of measures and structural transformations that will result in the efficient utilization of fixed capital and a reduction in material outlays, including fuel and energy. If we translate this into the language of practical affairs, what we mean is that the results of the production process must grow faster than the outlays for it, so that better results are achieved by enlisting fewer resources in the economic circulation process.

A New Stage--New Tasks

The need for the conversion to the intensive path of development became particularly urgent in recent years, when the growth of labor resources decreased noticeably, capital investments for the extraction of fuel and raw materials increased significantly, and the most accessible mineral deposits have become gradually depleted. The acuteness of the problems is intensified by the gigantic scales of our economy, which requires a huge amount of energy and raw material resources.

Right now, in one day alone almost 1.5 billion rubles' worth of energy and raw materials are consumed in the USSR. A reduction in material outlays of only 1 percent will make it possible to obtain an additional 6 billion rubles of national income. Every percent of savings of energy resources equals approximately 19 million tons of conventional fuel, which is equivalant to almost 2 billion rubles at present world prices.

At the present time in the USSR, more than 40 percent of the capital investments in industry (or about 20 percent of those in the entire national economy) are directed at the fuel extraction and energy production. In recent years the

appropriations for the fuel and energy complex have been growing faster than the level of production by a factor of 1.5, mainly because of the allocation of vast means to maintain the extraction level that has already been achieved. Therefore, economy of raw materials, energy and fuel and their rational utilization are becoming one of the decisive factors in the conversion to the intensive path of development.

The Way to Efficiency

In speaking of the rational utilization of energy, fuel and raw materials, it should be mentioned that it is not dictated by the resource "starvation" with which many leading capitalist states have already collided. The Soviet Union is reliably and for the long view provided with its own sources that are sufficient not only for the satisfaction of its own needs and the rendering of assistance to the fraternal socialist countries, but also for the maintenance of mutually profitable trade relationships with other states.

The attention that is now being given to economy of resources is the result of efforts to use them most nearly completely and efficiently by obtaining the greatest yield from minimal outlays. Besides this, it is important to take into consideration that the overwhelming majority of these resources--gas, oil and coal--are not renewable.

In striving for the practical realization of a course toward efficiency in all branches of material production and the nonproductive sphere, the CC CPSU and the Council of Ministers adopted a number of directive documents. One of them, the decree "On Strengthening Work for Economy and Rational Utilization of Raw Material, Fuel, Energy and Other Resources," stipulates:
an improvement in the structure of the national economy and its branches in order to achieve every possible reduction in their energy- and material-intensiveness, the maximum extraction of minerals from underground, and the integrated and thorough processing of raw materials;
the extensive introduction of scientific and technical achievements aimed at improving the efficiency of the utilization of construction and other materials and fuel, energy and raw material resources, along with the creation of the necessary systems of machines and highly economical technologies producing little or no waste products;
a sharp reduction in waste and losses of raw materials and materials at all stages of their processing, storage and transportation, along with the more nearly complete introduction into the economic circulation process of secondary resources and by-products;
the primary allocation of capital investments, equipments and capacities for the rational use of available resources.

Considering the high effect of energy conservation[1], the State plan for 1981-1985 outlines the savings of more than 200 million tons of conventional fuel in 1985 in comparison with 1980, including 146 million tons because of direct

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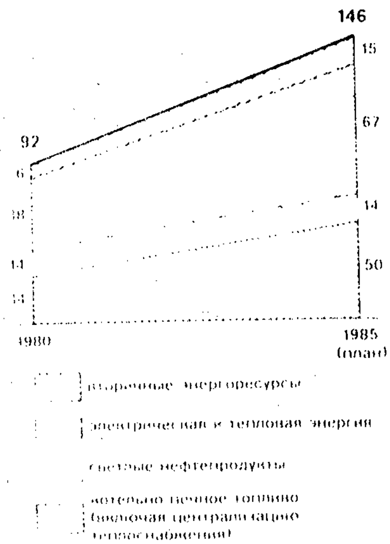
[1]As a rule, fuel economy measures require only one-half to one-third the means needed for an equivalent increase in extraction and delivery to the consumer.



Savings of fuel and energy in the USSR's national economy (in millions of tons of conventional fuel)
Key:
1. (Plan)
2. Secondary energy resources
3. Electrical and thermal energy
4. Light petroleum products
5. Boiler and furnace fuel (including heat supply centralization)

[bands, top to bottom, correspond to 2-5, respectively]

savings and about 60 million tons by replacing organic fuel with energy generated at atomic and hydraulic electric power stations.

As a result of this, the savings of resources in 1985 will be significantly greater than in 1980.

The Motto: Scientific and Technical Progress

A decisive condition for the fulfillment of the 11th Five-Year Plan's assignments is the extensive use in all branches of public production and the civil and domestic economy of the achievements of the scientific and technical revolution. The task is to introduce, on an accelerated basis, more efficient generating and fuel-using equipment and production processes and equipment that provides high-quality output for minimal energy resource outlays, in addition to achieving the outstripping introduction into operation of atomic electric power stations. At the same time, it is necessary to modernize existing and dismantle obsolete installations and machinery and optimize operating modes for the purpose of reducing significantly the consumption of fuel and thermal and electrical energy. There is expanding use of measures to reduce the material-intensiveness of the production process by: using improved construction materials, increasing the assortment of rolled iron goods, replacing metal with plastics, lightening the weight of designs used in construction, using more efficient methods for working articles (forging, stamping), utilizing powder metallurgy, increasing equipment service life, protecting metal against corrosion and others.

Without discussing all the measures in detail, let us mention only that many of them have a high potential for economy of resources. For example, the specific fuel consumption rate during the transition from power-generating units with capacities of 150-200 MW to 800-MW units drops by about 10 percent. The efficiency of fuel utilization in steam-and-gas units increases by 7-8 percent. When a centralized heat supply system goes into operation, specific fuel consumption rates decrease by 20-30 percent. The use of the so-called dry method of cement production makes it possible to reduce these rates by a factor of 1.5-1.8 in comparison with the traditional method. The introduction of powerful units for the production of several types of chemical products makes it possible to reduce this indicator by 20-30 percent.

Large prospects are also opening up for savings of oil and oil products in every possible way. Right now it plays a special role, since their consumption is constantly increasing, not only in industry but in other branches of the national economy, also. In motor vehicle transport, for example, the plans for 1984 are to replace about 100,000 tons of gasoline by gas, and for 1985 to convert about 1 million motor vehicles to gas, which will make it possible to save 8-10 million tons of gasoline per year.

The question of economy and rational utilization of oil products was examined by the CPSU Central Committee's Politburo. The need for unconditional implementation of the plans for creating efficient, fuel-saving equipment and technologies was pointed out, as well as the necessity of improving the system for standardization of and accounting for the consumption of fuels and lubricant materials and reducing sharply the losses of them

Growing attention is being devoted to the centralization of heat supply and the elimination of small boiler rooms that are not very economical. This is of vast economic and social importance because, on the one hand, it increases labor productivity and, on the other, the part of the personnel that are thus freed can be directed into other branches. In connection with this, many million tons of fuel are saved. An important role in the solution of this problem has been assigned to additional measures to improve the efficiency of fuel and energy management in cities and other populated points; these measures were planned in 1983.

To Introduce All Reserves Into Circulation

In the current five-year plan, a large place is assigned to increasing the level of utilization of secondary energy resources. The possible savings because of this are estimated to be approximately 14 million tons of conventional fuel in 1985. In order to solve such a complicated problem, plans have been made to organize the production of new types of heat-utilization equipment for the ventilation of industrial and public buildings and structures.

Extensive possibilities are available in the civil and domestic sectors, which use about 20 percent of the energy resources consumed in this country. The reserves for economy there are estimated to be 25-30 million tons of conventional fuel per year.

One extremely important reserve is the multiple use of second raw materials: scrap metal, waste paper and used oil products and other waste products, including ashes and slag ash at thermal electric power stations, as well as those products obtained during the extraction and enrichment of minerals. This will make it possible to save 10-12 million tons of conventional fuel in the future.

A special role is played by successive improvement of the economic structure of the country as a whole and individual parts of it. The main thing there is to reduce the share of energy-intensiveness production processes and to have a rational relationship between the rates and proportions of growth of energy-intensive and non-energy-intensive branches. The specific weight of ferrous metallurgy is being reduced and certain of its processes are being eliminated.

At the same time, the value and place of the food and light industry, the building of machinery and tools for science and other extremely necessary and--at the same time--non-energy-intensive branches are growing. Measures are being taken for the more nearly complete introduction into the economic cycle of local resources, the reduction of expenditures for the transportation of fuel, raw materials and other cargoes, and the intensive reduction of the energy-intensiveness of the production process in areas with inadequate intrinsic resources.

Along with the complex of measures for direct savings, an extensive program for replacing organic fuel with alternative sources is being implemented. The decisive element in it is the accelerated construction of atomic and hydraulic electric power stations instead of thermal ones. Actually, each 1 million kW of capacity at an AES makes it possible to save more than 2 million tons of conventional fuel every year. The use of heat from atomic TETS's and heat supply stations and geothermal, solar and wind energy will be called upon to make a definite contribution in the future.

Considerable attention is being given to the replacement of fuel oil. The measures being taken at the present time have as their purpose the insuring of success in the more effective solution of this problem. Already in 1984, its consumption at electric power stations is supposed to be reduced by 6 million tons. Next year this process will proceed even more intensively.

As experience has shown, every year an enlarged role in the economy of fuel, energy and raw material resources is being played by machine building and--in particular--instrument building, which must supply all branches with modern energy-saving equipment. A number of measures for the enlargement of its output have recently been instituted in the USSR. They are being implemented in accordance with the CPSU Central Committee and USSR Council of Ministries decree (April 1981), "On Basic Directions and Measures for Increasing the Effectiveness of the Utilization of Fuel and Energy Resources in the National Economy From 1981 to 1985 and in the Period Until 1990," which defined the ministries' and departments' specific assignments for the production of the appropriate equipment.

On a Planned Basis

The scale and depth of the measures being realized are caused by the need for a purposeful, integrated approach to their development and realization. The most important thing here is planning, in the process of which the main directions for activity and the financial, material and technical support are defined.

In order to intensify the planned beginnings in energy resource economy, since 1982 USSR Gosplan has been developing a special program for the entire national economy. Inasmuch as the problem is of an interbranch nature, many USSR ministries and departments have been enlisted in its solution, along with branch and territorial control agencies.

Stimulation of the rational utilization of resources is of great value. A number of measures have recently been adopted. As a result, up to 90 percent of the value of saved fuel and energy now remains at the disposal of the

enterprises. Up to 75 percent is allocated for payment of bonuses. Economic sanctions for overconsumption are being expanded.

Special mention should be made of the growing role of science in the conduct of an active energy-saving policy. Soviet scientists have already achieved substantial results. Thanks to their efforts, for example, a qualitative new method for converting organic fuel into electrical energy--the so-called magnetohydrodynamic (MGD) method--has been introduced. Its industrial mastery promises a huge effect. Also promising is the creation of special pumps for the conversion of low-potential thermal energy into energy at a higher temperature that is suitable for use in heating, ventilation and other installations. Important problems are being faced in the development of new and more energy-economical technologies in such branches as metallurgy, the chemical industry, the production of construction materials and others.

Developing Cooperation With Fraternal Countries

The resource-saving policy that is being realized in the USSR encompasses a large complex of questions. Their solution is being facilitated by participation in the international division of labor and cooperation with other countries (primarily those of the socialist collaboration), as well as the mastery and introduction of new technical facilities and production processes.

Significant work in this direction has been done within the framework of CEMA in recent years. It is reflected in the appropriate DTsPS [Long-Term Goal-Oriented Cooperation Program] for the period until 1990 and in the decisions of the CEMA Session, its Actuating Committee and other agencies of the council.

In ferrous metallurgy, for example, the fuel and energy balances for 1981-1985 and ways of improving them in the period until 1990 have been worked out on a multilateral basis. Proposals have been made for improving the technical level of burner units and furnace equipment for the production of rolled iron and refractory materials with better heat-insulating properties. Measures are being introduced to increase the blast temperature in blast furnaces, replace fuel oil with natural gas in the steel-smelting industry, use the heat of waste gasses and so on. It is assumed that these and other measures that are being used on the basis of multilateral cooperation will make it possible to obtain an annual conventional fuel savings of about 0.6 million tons in the NRB [People's Republic of Bulgaria] in 1985 in comparison with 1980; the respective figures for the VNR [Hungarian People's Republic] and the ChSSR [Czechoslovakian Soviet Socialist Republic] are 0.3 and 0.8 million tons. In the GDR and the USSR, energy resource consumption will drop by 2 and 5 percent, respectively. The joint efforts of the CEMA member countries are also being used to carry out a large amount of work in nonferrous metallurgy, the chemical and light industries, transportation and other branches. The most important place in the DTsPS is occupied by measures to deepen the refining of petroleum and increase the specific yield of light petroleum products because of the reduced use of fuel oil and its replacement by coal, as well as by electricity generated at AES and, where necessary, the expansion of the use of natural gas, including as a replacement for petroleum products.

Cooperation is also being developed steadily on a bilateral basis. For instance, the USSR and the GDR are conducting research in experimental residential complexes in the cities of Gor'kiy and Magdeburg. The research concerns both construction techniques and technology and technical and engineering support for energy conservation. Approximately 8,000 apartments will be built in each city during the experiment. Fuel consumption for the heating of the buildings is supposed to be reduced by about 30 percent in comparison with the present level.

Primary attention is also being given to economy of fuel, energy and raw material resources in the national programs that have been adopted by the highest Party and state agencies in the fraternal countries. It is having positive results. For example, from 1971 to 1980 in the GDR energy consumption increased only 11 percent, although industrial output grew by 80 percent. Much has been done in order to improve the designs and reduce the weight of equipment. Although 2,099 kg of original materials were consumed per 1,000 types of commodity output in 1970, in 1981 the figure had fallen to 1,345 kg. In this five-year plan, commodity output will increase by 5 percent per year while material outlay remains stable. About 10-12 percent of the raw material requirements in the GDR are met with secondary resources, including 75 percent of the rolled steel goods, 35 percent of the copper, 50 percent of the paper and so on.

The measures being implemented in the countries of the socialist concord show how much can be achieved in the more rational utilization of resources, what economic effect this gives, and how it makes it possible to save the fuel, raw materials and energy that are needed by the national economy. At the same time--and it is necessary to speak bluntly about this--here there are still many unused resources and capabilities, and there are unresolved problems. This refers primarily to reducing the specific consumption of primary resources for production output. In a number of cases it is much higher than at the foremost enterprises and abroad. So here is the task: to eliminate high, economically unjustified overconsumption that, for the socialist brotherhood as a whole, amounts to many tens of millions of tons of fuel and raw materials.

The development and introduction of measures for economy of resources is an important direction in the scientific, technical and production collaboration of the CEMA member countries and the further development of socialist economic integration. That this is so is indicated by the results of the 38th meeting of the CEMA Session, which was held in Berlin in October 1983.

Having noted the particular value of the implementation of measures for the rational utilization of material resources in the fraternal countries, the Session outlined the basic ways of solving the problem. They are:
the realization of progressive structural shifts in branch and territorial profiles for the purpose of accelerated development of the less energy-intensive branches and the rational placement of energy- and material-intensive production facilities in the CEMA member countries;
the development, by collective efforts, of a system of specific and effective measures aimed at sharply reducing fuel, energy and raw material losses and introducing secondary resources into the economic cycle as much as possible;
the expansion, in every way possible, of cooperation in the creation and manufacturing of equipment, technologies with little or no waste products, control

and measuring instruments and automatic equipment for regulating energy consumption, and their introduction into the production process as rapidly as possible.

The formation of a modern material and technical base for saving fuel, energy and raw material is a pivotal international problem. The effectiveness of the energy-saving policy being conducted in these countries depends on its solution to a considerable degree.

Further expansion and deepening of the fraternal countries' interaction in the saving and rational utilization of material resources is playing a growing role in the successful solution of the fuel, energy and raw material problems. And the sooner we use this reserve, the more rapidly we will achieve the conversion of our economies to the intensive path of development.

11746
CSO: 1822/390

PETROCHEMICAL INDUSTRY UNCOORDINATED, INEFFICIENT

Moscow IZVESTIYA in Russian 18 May 84 p 2

[Article by R. Lynev, special correspondent of IZVESTIYA: "Answers and Responsibility"]

[Text] The decree of the USSR Council of Ministers, the integrated program for scientific and technical progress, coordinated by the USSR State Committee for Science and Technology, and the special order of the Minister of the USSR Petroleum Refining and Petrochemical Industry provide development of new highly effective catalysts by industry, capable of sharply intensifying production processes in petrochemistry during this 5-year plan.

IM-2206 catalyst, proposed by the laboratory under the supervision of Professor G. Kotel'nikov, figures among others in the named documents. It was said in the minister's order that experimental industrial tests of this catalyst had been completed and the deadline for introduction of it was named.

However, the working documents of the ministry indicate that the catalyst has not yielded the expected increase of production, while its quality has deteriorated.

Slowing of progress in development of highly effective catalysts was noted in the report of the interdepartmental commission, which checked the work of the head scientific institution of the sector--the Yaroslavl Institute of Monomers of Synthetic Rubber--at the end of last year. Among the main causes of this, the commission named the poor operation of the mentioned laboratory under the supervision of G. Kotel'nikov. This was also indicated in the article "Co-author among advocates," printed in IZVESTIYA on 25 January 1984.

The answer of the Minister of the USSR Petroleum Refining and Petrochemical Industry, V. Fedorov was sent to the newspaper. It was noted in it that the raised question about the work of the head institute was considered in detail by the ministry. "It was established that the institute has permitted the occurrence of conflict situations during the past few years both inside the institute and with recruited organizations and has insufficiently utilized the opportunities to coordinate research.

The inadequate level of the equipment production developments at the institute led to non-reducibility of the high indices of catalysts on industrial scales, achieved in laboratories and at experimental plants."

The minister continues that all this was the result of weakening of management by the institute on the part of director G. Stepanov and of his deputy A. Bushin. "The ministry implemented decisive measures to improve the work of the institute: G.Stepanov and A. Bushin were relieved of their duties, highly qualified specialists were selected to replace them and the composition of the scientific council was reviewed. The work of the laboratory, headed by Doctor of Technical Sciences, Professor G. Kotel'nikov, was reviewed by a new staff of the scientific council, management and party organization of the institute."

Having ended with this part of the answer and clearly not wishing that it outweigh the following "positive" part, the minister recalls that there is also much good in the work of the institute and its collective has a number of services to the sector.

One may recall here that these services were not doubted by anyone. The newspaper criticized only some, nevertheless important aspects of the work of the institute and of the ministry and named specific guilty parties. Two of them were not fired, they were honorably retired.

But the important thing is what the answer does not report. Thus, there is no mention at all of the multiauthor associations in which the key figures were the former director of the institute, his deputy, the same G. Kotel'nikov and responsible workers of the ministry. Who and why were powerful author's cliques required? The facts speak clearly: this coauthorship was frequently determined by the service situation of the members rather than by their creative contribution. Objective criteria in evaluation of this "creativity" were replaced by laudatory self-evaluations, criticism was noted, but competing groups under the imprint of the head institute were silent or ceased to exist. The omnipotence of a single group and its influence on the sector increased, the totals of prizes increased, and the feeling of anything goes was strengthened.

And how was this reflected in science? And how is it reflected in production efficiency? The specialists attempted to turn the attention of the ministry that a series of catalysts proposed by the laboratory of G. Kotel'nikov et al. are not new, highly effective developments at all, but modifications--according to some elements simply renaming--of what has been known since the 1950s.

This exactly led to the "conflicts," about which the minister reports and to that which was called "insufficient use of opportunities for coordination" in the answer.

Such a departure from direct evaluation is the statement of the ministry that it "has no right" to review the question of conferring foreign developments on Stepanov, Bushin and Kotel'nikov. How is this so? Does the ministry have the right to fire Stepanov, but it does not have the right to correct the error which he committed? Where is the logic in this? Can the ministry share its confidence with this approach that "correct conclusions are made at the institute from the criticism"? It is doubtful. And the response of the institute, signed by the new director Ye. Kopylov and by the secretary of the party committee V. Shmarlin, confirms these doubts.

As the minister, he begins what is said to be a toast: the problem is raised correctly, on a timely basis, and the criticism is recognized--"The institute coordinated the efforts of the coexecutors inadequately" and "delays were permitted with introduction of the catalysts needed by industry." and the party committee, it is reported further, indicated to G. Kotel'nikov "for failure to implement effective measures to introduce the new catalysts in industry and required a stricter approach from him toward organization of cooperation both within the institute and with specialists of other organizations, without permitting cases of an inattentive attitude toward people and the occurrence of conflict situations."

And what about the recruitment of influencing coauthors? But the named comrades, the report affirms, actually undertook creative participation. True, the party committee pointed G. Kotel'nikov toward the need for further organization of their number.

And later, having criticized G. Kotel'nikov and the institute as taking unilateral action, the authors attempt to correct the "one-sidedness" by an oral panegyric to G. Kotel'nikov. Moreover, letters are coming into the editorial offices to this day about how he unceremoniously with the aid of the former director and deputy settled with his rivals.

In short, this is usually how criticism is answered which cannot be denied and one does not want to recognize. You will not call this approach businesslike. As you will not recall that after the work of the interdepartmental commission at the institute, the secretary of the party committee V. Shmarlin boldly stated that its conclusions will be enough for the collective "until the end of the 5-year plan." Alas, pretentious principle has given way to clear lack of principle.

Experience shows that if clothing (uniform) is cleaned by substances other than those which should be used, the spots are embedded deeper. It will then be more difficult to remove them.

6521
CSO: 1822/320

GENERAL

DELAYS IN STARTUP OF CHIMKENT PETROCHEMICAL PLANT DISCUSSED

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 27 Apr 84 p 2

[Article by Yu. Livinskiy, special correspondent of KAZAKHSTANSKAYA PRAVDA: "Until Problems are Resolved"]

[Text] Oil arrived at the site of the Chimkent Petrochemical Plant, under construction, one year ago through the newly constructed 1,642-kilometer Pavlodar-Chimkent Transsiberian major oil pipeline. Since then, the oil river has been flowing here round the clock, filling the storage tanks with the "black gold." And after being pumped into railroad tank cars, the oil is shipped from here to the refining enterprises of fraternal Uzbekistan.

The significance of startup of this major petroleum pipeline is difficult to overestimate. It has already resulted in an enormous saving.

But this saving could become more significant if the petrochemical plant had been operational by the time the oil arrived. This enterprise has been under construction for more than 10 years. Such long periods are explained by different factors, including objective factors. But for one reason or another, the construction of a very important facility is being severely drawn out. Thus it has happened: oil arrived from Siberia at Chimkent, but the plant for refining it was unfinished.

Startup of the major oil pipeline changed the situation and required adoption of emergency measures to accelerate construction. Considerably more funds than earlier were allocated for last year and this year. The builders are faced with a crucial task--to concentrate every effort and opportunity for the most rapid startup of the first unit of the petrochemical giant. But last year they, unfortunately, did not cope with the posed task. More than 1.5 million rubles remained unassimilated of 10.2 million rubles allocated for construction and installation work. An especially long lag was observed in installation of the main facility of theconstruction site--the combined plant for preliminary processing of KL-6U oil. One-tenth of the work planned for the year was not fulfilled here.

This interruption was permitted primarily as a result of late delivery deadlines of assembled steel sections and pipe. Delivery of them to the construction site began mainly in November-December, when there was no longer anyone

to install them, since the Chimkentpromstroy Trust had transferred almost the entire work force to other facilities during this time.

The underassimilated funds were included in the plan for the current year. But the current program of the builders is very complicated even without that: they must start up the large capacities of the LK-6U starting complex before the end of the year, for which approximately 30 million rubles must be assimilated in total complexity. This volume of work required that the number of workers, mechanisms and transport be increased considerably and that the forces of six general contracting administrations of the Chimkentpromstroy Trust and 14 subcontracting organizations be combined.

The results of the first months of the year indicate that the construction and installation organizations knew how to cope with the total plan. However, the contribution of each of them is unequal. Many contracting and subcontracting organizations labored well. But, for example, PMK-24 [mobile mechanized column] of Kaztyazhekskavatsiya Trust interrupted the work front for the builders on many facilities of the starting complex and Chimkentspetsstroy Administration [Chimkent Administration for Special Construction and Installation Work] of Glavyugstroy [Main Administration for Construction of Enterprises in Southern Regions] did not know how to complete the work on time and fully in laying underground supply lines. Many production interruptions also inhibit the work.

Specifically, the problem of design documentation for the starting complex required a long time to resolve. Even during the first few days of January, the client and the Azgiproneftekhim Planning Institute gave the contractor written authorization to construct the LK-6U installation from drawings published on 1 January 1983. But approximately 1 month later, a letter arrived from the planning institute in which it was said that the LK-6U installation should be erected from the newly dispatched drawings, corrected "with regard to startup and operation of similar installations and brought into conformity with existing norms and regulations." Otherwise, it was emphasized in the letter, the institute would have no further responsibility for startup and operation of LK-6U.

The board of directors of the plant then began to insist on the need to construct the installation according to the new drawings. The builders were placed in a very complicated situation. Additional equipment and material resources were required. Where could they be obtained when the official deadlines of applications for orders had long passed?

Similar installations were started up much earlier. Why then was the corrected design documentation not delivered on time? The builders essentially did not have anything against the new drawings, understanding that it was more reasonable to erect the LK-6U from them in the interests of the matter than later, after completion of construction, and to begin reconstruction of the installation. But since the delay with delivery of the corrected documentation was through the fault of the client and designers, they felt, then let them find the additional resources. In short, the problem of the design documentation was debated until March until the USSR Ministry of the Petrochemical Industry finally made an official decision about deliveries of the missing

equipment during the first 6 months of the year and transfer of their own funds of supplementary material resources to the builders, not provided by the old design.

The construction of the plant has felt an acute shortage of work force from the very beginning of the year. Thus, according to measures confirmed by Mintyazhstroy [Ministry of Heavy Construction] and Minmontazhspetsstroy [Ministry of Special Construction and Installation Work] of the republic, 2,600 builders and installers were supposed to be working at the construction site of the petrochemical plant, but there were only 1,900 of them. There is an especially acute shortage of installers. It is no accident that the collectives of the Chimkent and Southern Kazakhstan installation administrations of the Kazkhimmontazh Trust, to which falls the greatest volume of work, have until now been working mainly on a single shift. Incidentally, there are as yet no second shifts in the other subdivisions as well. Hence the lag, interruptions of tasks and untimely presentation of a work front to the related workers.

The circumstance that the plants of Minmontazhspetstroy of the republic have underfulfilled the plan for manufacture of assembled steel sections during the first quarter is also disturbing. As a result, work on such facilities as the LK-6U installation, circulating water supply, reagent facility, materials-raw material base and a number of others is being delayed.

"Moreover," says the chief of the staff of the starting complex B. Yakubonek, "the proper measures have not yet been implemented in the ministry to develop a base for manufacture of pipe assemblies at Chimkent. And approximately 13,000 tons of them are required here. Perhaps it isn't worth talking about the fact that manufacture of assemblies by the industrial method is a decisive factor in acceleration of installation work." Serious complaints are also being made against the client. He has not yet become an example of clear executive action. For example, the installers are experiencing great difficulties due to underdeliveries of production equipment.

A continuous brigade contract has recently been practiced to accelerate the rates of work and to concentrate the efforts of all participants of construction into a unified flow on large starting objects. The good experience of introducing this progressive form of increasing the efficiency of work has also been accumulated at the construction sites of Chimkent. Specifically, it played the main role in turnover of starting objects ahead of schedule at the production association Chimkentshina. But it is being introduced slowly at the construction site of the petrochemical plant. True, the documentation for a continuous contract is now being formulated at Chimkentpromstroy Trust However, this preparatory work has clearly been drawn out.

As can be seen, despite the fact that the omitted funds are being assimilated as a whole at the important construction project since the beginning of this year, there are very many unutilized reserves for increasing the efficiency of construction here. The main topic for today is to set them in operation very rapidly and to eliminate the existing deficiencies and interference. And the efforts of everyone who participated in the birth of the republic's new petrochemical giant should be subordinated to solution of this problem in identical measure.

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GENERAL

ACTIVITIES OF NOVOKUYBYSHEV PETROLEUM REFINING PLANT DISCUSSED

Moscow SOVETSKAYA ROSSIYA in Russian 23 May 84 p 3

[Article by V. Petrushin, deputy chairman of KNK of Novokuybyshev Petroleum Refining Plant, and A. Bochkarve, special correspondent of SOVETSKAYA ROSSIYA: "Warehouses and Mismanagement"]

[Text] It looks like a museum. There is the excursion guide and there are unique exhibits. One looks at their price tags and one is amazed: six- and seven-digit numbers take form. And everything was assembled here within the "shortest" deadlines. Minneftekhimprom SSR [USSR Ministry of Petroleum Refining and Petrochemical Industry] required something like 5-7 years to become the owner of an unforeseen collection. True, it is shown at the production association Kuybyshevnefteorgsintez only to selected visitors for the time being. These are mainly managers of the sector and perhaps workers of people's inspection and prosecutors. A regular commission arrives and immediately the reserves are sent to the bases. How does one save a people's contribution here?

The attention of the controllers is justified: the association now has equipment worth tens of millions of rubles for oil refining. And who knows what would become of it if not for the commission. Material valuables must be cherished as the apple of one's eye. Old guards recall that someone initially displayed negligence. For example, plant managers, having naively checked that reconstruction is under way in shops, install something from the solid reserves so that there are at least rectification columns and pipes. They hoped and "were burned out" for nothing. One chief was relieved of his duties. Other managers were strictly punished for the first signs of rust on the columns.

It was then decided at the association that the "frozen millions" could be preserved only on a centralized basis. The responsible work was entrusted personally to deputy general director for capital construction L. M. Avrakh. One will not be amazed at what he has to do. When construction of the next objects is begun, they will finally begin reconstruction. They thought aprpxoimately the same thing at Minneftekhimprom, being interested in preservation rather than in the use of equipment in production.

"Perhaps the sector simply does not need all of this?" we asked the chief supervisor of valuables L. M. Avrakh, and we point out the racks loaded with

crates, judging by aesthetics, allocated from funds of USSR Gosplan as early as 1979.

"Please," the deputy general director counters. "This is a remarkable, excellent installation. It cleans oil of water and salts and permits one to produce valuable fractions from gases and high-octane gasolines to tar. This is actually hardly a complete plant. It is very productive with capacity of millions of tons annually.

Without going into the details of technology, we understood the main thing that all this is purely theoretical, since the remarkable complex has not produced a single gram of gasoline and its parts are packed in crates. And there were stacks of other racks in the neighborhood. Various types of installations, equipment and instruments, also called upon to accelerate development of the sector, and to improve and renovate methods of production of polyethylene, propylene, phenol and a number of no less valuable products.

But how has it happened that the latest installations have not found their elementary work for many years, they waste time in warehouses and are becoming physically obsolete? We attempted to analyze the history of petrochemical capacities for which one so zealously fought earlier, but now they have actually become frozen. Let us leaf through the endless correspondence of Minneftekhimprom with the association and let us read hundreds of lists, requests, promises and refusals. There are also orders signed personally by the minister. Strict papers sometimes require that reconstruction of enterprises be begun, otherwise matters are postponed for unspecified periods. One can actually understand one thing from the complicated changes: the ministry does not yet have its own clear position.

And it's all in vain. The plants of Nefteorgsintez are in extreme need to replace many basic funds. Many installations did not provide even the lowest product quality. Sanitary organizations rightfully raise the question, noting the extreme pollution of the soil and the haziness of the atmosphere. But the builders fanned the flame when they dug the trenches. Instead of the expected underground waters, they found high-quality gasoline. It had been leaking into the soil for a long time from operating, but worn out equipment.

The products of the enterprise--fuel and lubricating oils--also sometimes cause censure. Add a large volume of manual operations, turnover of the work force and chronic interruptions of plans and it becomes immediately clear how much reconstruction of the Kuybyshev plants is needed. And they would be provided with new equipment to their profit if only everything would be started in economic circulation.

As early as 1977, Minneftekhimprom gave its word on the important matter. And later it was as if an evil force began to confuse all the plans. Obviously, the time has come to answer the numerous questions of what to do with the frozen equipment. Then they suddenly decided in the sector to transfer part of the funds to other enterprises. However, whether they will finally unfreeze them and begin to take action, no one is confident of. It is natural that the unexpected turn of the ministry aroused the indignation of local authorities. The CPSU obkom knew how to vindicate its opinion.

Minneftekhimprom has now again been forced to change course and to find the next solution. What it will be is unknown. And the equipment is still in the same warehouses. Will it be transformed to "relics" of mismanagement, having lain in crates for the normative period? Should not the sectors soon appeal to Gosplan and request funds for new, more modern equipment? And will the new equipment not be immediately allocated to it for storage?

From the editors. The facts covered in the article are unfortunately typical for a number of other enterprises of the sector. One can name as many addresses where equipment worth millions of rubles is also sitting in warehouses, becoming obsolete and is being spoiled. This includes the Voronezh Tire Plant and the association Groznefteorgsintez. What enviable persistence was earlier manifested at Minneftekhimprom when scarce funds were knocked out at Gosplan and a need for fundamental reconstruction was proved. It was proved in figures and facts, requiring preference of one's own sector. Where then are the bold aspirations?

The question is especially timely today. The fraction of old equipment is increasing sharply in petrochemistry. Only 0.7 percent is being renovated annually. One cannot work very much with antediluvian installations and one cannot produce the full volume of products required by the state. One will also not provide high quality and the proper conservation.

The time has come to strictly question the managers of the sector. Which of your personnel, comrades, is responsible for new equipment? When will the equipment worth many millions of rubles begin finally to operate? It is obvious that Gosplan and a number of construction ministries, related to reconstruction of industry, should also be interested.

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GENERAL

OIL PRODUCTION ON BUZACHI PENINSULA REPORTED

Moscow STROITEL'NAYA GAZETA in Russian 11 Mar 84 p 4

[Article by V. Azarov: "City for Oil Workers"]

[Text] The "Plan for settlement of oil workers" on Buzachi Peninsula has been confirmed. It provides for construction of a workers' town on the shore of the Caspian Sea.

The promising oil fields of these difficult, remote sites have already yielded approximately five million tons of oil this year. Buzachi is being developed at very vigorous rates and many unique innovations in oil production are being utilized here. And the watch method of work, now being used, is unsuitable for Buzachi. Specialists of the association Mangyshlakneft' have calculated that if 3,000 persons are carried by motor and air transport to the peninsula, this figure will triple within 15 years.

Having studied all the socioeconomic factors, the managers of the association have proposed that a town be constructed on Buzachi. Kazgiprograd Institute has studied several variants and issued the optimal calculation.

The new town is being constructed not far from the sea. A highway, laid across Komsomol'skiy Proliv, will eventually connect it to other regions of the country. The USSR's first specialized watch airport is already operating nearby.

Tomorrow's town will also have from its birth a reliable supply of electric energy and water supply from the nearby Kyzyl Kum field. It also has its own gas. The geologists are looking for construction materials in the vicinity.

By 1990, 15,000 persons will live permanently at Buzachi.

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GEOLOGISTS AWARDED FOR GAS DISCOVERIES

Ashkhabad TURKMENSKAYA ISKRA in Russian 17 May 84 p 1

[Article: "Awards to Prize Winners"]

[Text] On 16 May, a group of Turkmen scientists and producers were awarded certificates and honorary badges as winners of the USSR State Prize of 1983 at the Central Committee of the Turkmenistan Communist Party in the field of science and technology, which they won for discovery and accelerated and highly efficient prospecting of the unique Dovletabad-Donmez gas condensate field. Among the winners were the chief of the Central Geophysical Expedition of the Administration of Geology of the Turkmen SSR R. Ataniyazov, the former chief geologist of the Eastern Geological-Geophysical Expedition, now chief of the Bayram-Aliysk Oil- and Gas-Prospecting Expedition of UG [Administration of Geology] of the Turkmen SSR R. Ye. Chavushyan, the chief engineer, deputy chief of the Administration of Geology of the Turkmen SSR Yu. A. Gavrilov, the chief of the oil-prospecting expedition of the Administration of Geology of the Turkmen SSR F. G. Belen'kiy, the chief geologist of the oil-prospecting expedition of the Administration of Geology of the Turkmen SSR R. S. Smirnov, drilling foreman of the oil-prospecting expedition of the Administration of Geology of the Turkmen SSR V. V. Shumskiy, the chief of the central engineering production service of the oil-prospecting expedition of the Administration of Geology of the Turkmen SSR, Candidate of Geological-Mineralogical Sciences D. A. Kolatov, director of the Turkmen Scientific Research Geological Prospecting Institute, corresponding member of the Turkmen SSR Academy of Sciences Ya. A. Khodzhakuliyev and the chief of the operational analysis party of the Turkmen Scientific Research Geological Prospecting Institute, Candidate of Geological-Mineralogical Sciences A. N. Davydov.

Member of the CPSU Central Committee, first sectretary of the Central Committee of the Turkmenistan Communist Party M. G. Gapurov handed out the awards. In the name of the Central Committee of the Turkmenistan Communist Party, the Presidium of the Supreme Soviet and the Council of Ministers of the Turkmen SSR, he heartily congratulated the awardees and wished them great creative success. The labors of the new winners, Comrade Gapurov emphasized, indicate the increasing level of the geological service in the republic and the role of the research of geologists in acceleration of the race of scientific and technical progress.

Scientific secretary of the Committee for Lenin and State Prizes in the Field of Science and Technology attached to the USSR Council of Ministers, Doctor of Technical Sciences V. N. Chetverikov, who participated in the solemn ceremony, warmly congratulated the winners and hoped that they would multiply the success of the Turkmen prospectors in the future and would increase the country's fuel and energy potential.

In accepting the awards, the winners expressed deep gratitude to the CPSU Central Committee and to the Soviet government for high evaluation of the work and stated that they will direct all their efforts in the future toward further development of the republic's national economy.

The second secretary of the Central Committee of the Turkmenistan Communist Party A. I. Rachkov, the chairman of the Council of Ministers of the Turkmen SSR Ch. S. Karyyev and other leaders of the party and government of the republic were present at the awards.

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GENERAL

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NONEQUILIBRIOUS PLASMA-CHEMICAL HYDROGEN PREPARATION URGED

Frunze IZVESTIYA AKADEMII NAUK KIRGIZSKOY SSSR in Russian No 5, 1983 pp 3-9

[Article by Zh. Zh. Zheyenbayev and D. K. Otorbayev (Institute of Physics and Mathematics, Kirghiz SSR Academy of Sciences): "Methods for Obtaining Hydrogen--the Energy-Engineering Fuel of the Future"]

[Text] Atomic-Hydrogen Energy Engineering. The growth in scale of production and technical progress have made it necessary to constantly increase energy consumption. It is expected that the rate of growth of world consumption of energy will also increase in the future and will be 3-4 percent per year [1]. The opportunities for satisfying this demand for energy are defined by the existence of energy-resource reserves, and also by the cost of extracting the energy. Because of this, the necessity for an increase in the growth of nuclear power is determined primarily by economic factors. And the matter here is not only that of the limited nature of the reserves of ordinary fuel. It is known that there is much coal on Earth, and by the end of the century no more than 2-3 percent of it will have been consumed [2]. There will be no coal shortage for several centuries. However, the high cost of the coal itself and of transporting it over great distances and the ecological effect of consumption of the coal's energy will lead to the noncompetitiveness of this fuel in areas distant from the coal fields. This is why an ever-increasing share of energy consumption has been covered by oil and gas in recent decades. However, first, world reserves of these fuels are limited, and second, oil and gas are valuable chemical raw materials.

A forecast of the development of future power-engineering that would enable an optimal energy-engineering developmental strategy to be defined is extraordinarily important. Figure 1 shows a variant of the development of energy engineering for a model of an industrially developed society with a population of 250 million people at the initial date of 1970 [3]. It gives a representation in particular of the necessity for developing and introducing most intensely other, nonelectrical ways for using nuclear energy.

The use of traditional types of raw materials becomes not at all mandatory, given sufficient support of industry by nuclear energy. Water, on being broken down into the source molecules, can yield an energy carrier that is optimal for various production purposes. This is important, since, as is known from figure 1, solution of the problems of energy engineering is possible only by using nuclear sources for producing heat, hydrogen and electricity.

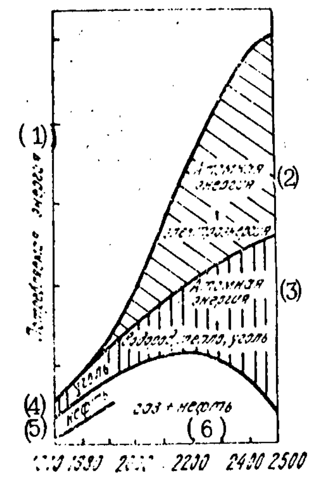

Figure 1. Forecast of the Development of Energy Engineering up to the Year 2050 for a Model of an Industrially Developed Society with a Population of 250 Million People in the Initial Period of 1970 [3].

1. Energy demand.
2. Nuclear energy--electricity.
3. Nuclear energy--hydrogen heat and coal.
4. Coal.
5. Oil.
6. Gas and Oil.

As for hydrogen, the desirability of its use is determined by the following factors: an unlimited amount of the raw material (water) exists for obtaining hydrogen; hydrogen is a good energy carrier from the standpoints of both its use and the transporting of it; hydrogen is an ideal fuel from the ecological standpoint: actually, the only product that is formed from its combustion is water; and the storage of hydrogen is a simple and reliable method for accumulating energy.

The Use of Hydrogen as an Energy Carrier. The table shows the physical properties of hydrogen in comparison with those of methane--the main component of natural gas.

Property	H_2	CH_4
Melting temperature, degrees C......	-259	-184
Boiling temperature, degrees C......	-253	-162
Heat of combustion:		
Kilocalories/mole...............	68.35	212.8
Kilocalories/gram...............	34.17	13.3
Heat of combustion per 1 kg of the fuel mix with oxygen, kilocalories...................	3,800	2,660

It is evident from this table in particular that hydrogen possesses a higher calorific value than methane. It can also be noted from its physical properties that hydrogen is highest among the gases in speed of diffusion and heat conductivity, factors that promote good dispersion of it (this is important from the standpoint of safety equipment), and it also enables hydrogen to be used effectively as a cooling or heating gas.

Hydrogen's chemical properties also are singular: it is one of the most powerful reducing agents, especially in its monoatomic form; it forms compounds that are used widely in the national economy (ammonia, acids, gasoline, and so on); it enters into reactions with metals, forming metallic hydrides; and so on.

The prospects for using hydrogen in various branches of the national economy are simply universal [3]. In power engineering it could even displace natural gas. From both the economical and ecological points of view, such a replacement is desirable. Moreover, energy can be transported over great distances by means of hydrogen. In ferrous metallurgy, even now, methods for the direct reduction of iron from ore by means of an energy carrier (hydrogen and carbon monoxide) are well known, and later these methods should be developed

intensely. In the chemical industry, aside from using hydrogen in the synthesis of ammonia and methanol, and in hydrogenating fats, and so on, substantial amounts of it are required for synthesizing a number of valuable organic products. In transport, liquid hydrogen can be used as motor-vehicle and aviation fuel. In the household, hydrogen can replace natural gas and also take over the function of heating and lighting for housing.

Moreover, substantial amounts of hydrogen will be required in the future for producing synthetic liquid fuels by hydrogenating coal.

About 30 million tons of hydrogen are produced in the world annually. About 90 percent of this amount is used in the chemical industry for synthesizing ammonia, methanol, and so on. The remainder of the hydrogen consumed goes to ferrous metallurgy (for the direct reduction of iron) and to the production of synthetic fuel (the gasification of coal). By the year 2000, the world's annual hydrogen consumption for various purposes can amount to 60 to 90 million tons. Thus, the task of searching for optimal methods for obtaining hydrogen are extraordinarily urgent.

Methods for Producing Hydrogen. Many different methods for producing hydrogen are now being used and developed. Their efficiency is evaluated on the basis of a combination of such indicators as energy efficiency, specific productivity, raw-materials costs and so on. The final assessment is made according to the cost of the process, which reflects its k.p.d. [efficiency]. Let us note the four main methods for preparing hydrogen, which either are now being used widely or are of greater interest for the long term [4 and 5]: 1--the conversion of natural gas and petroleum products; 2--the gasification of coal; 3--the electrolytic decomposition of water; and 4--the plasma-chemical method for the decomposition of water.

1. The Conversion of Natural Gas and Petroleum Products [4]. The main portion of industrial hydrogen is obtained this way today. Catalytic conversion of methane and of petroleum products in tube furnaces, especially the steam conversion of methane, have been used most widely. This is explained by the simplicity of implementing the process and by superior economic indicators. With steam catalytic conversion, the process ordinarily is used at a pressure of 15-20 atmospheres at temperatures of ~400 degrees C, in the presence of a catalyst (most often this is nickel). On the whole, the process enables enough pure hydrogen to be obtained at tolerable cost, but its efficiency does not exceed 60 percent, which is impermissible for use in the distant future. Moreover, valuable organic compounds--gas or oil, the cost of which will increase another 5-fold to 10-fold by the year 2000--are used in this production process.

2. The Gasification of Coal [4 and 6]. The growing expensiveness and the increasing shortage of oil and natural gas will, with greater insistence, require a search for new ways for preparing hydrogen. One of these paths is the steam reforming of bituminous coal with the participation of catalysts. Study of this process indicates that the heat given off during coal-burning is not enough to sustain the endothermal reactions of its interaction with CO_2 and H_2O. In order to intensify these reactions, additional heat must

be conducted into the gas generator. It is obvious that one of the ways for reducing energy expenditure and for saving unrenewable mineral fuels should be that of reducing the process's pressure and temperature, which can be done by using an effective catalytic additive. Let us note that during this process of obtaining hydrogen, practically all the carbon is discharged into the atmosphere in the form of an ash. This is undesirable for ecological reasons, and, moreover, it is still less efficient than converting it into methane (gasification) or synthetic oil (liquefaction).

While methods for obtaining hydrogen that are based upon the use of valuable mineral or fossil fuels will retain their value in the next few years, they should, inevitably, give way in the long term, as a result of raw-material and ecological restrictions, to other methods. In the search for new methods and new raw-material sources, many researchers are paying attention to water, the world reserves of which are practically inexhaustible. In this connection, let us review two of the more promising methods for obtaining hydrogen by the decomposition of water.

3. The Electrolytic Decomposition of Water [4 and 7].

$$2H_2O \begin{cases} \nearrow 2H^+ \rightarrow 2H^+ + 2e^- \rightarrow H_2 \uparrow \\ \searrow 2OH^- \rightarrow 2OH^- - 2e^- \rightarrow H_2O + 1/2O_2 \uparrow \end{cases} \quad (1)$$

The purity of the output obtained--99.99 to 99.999 percent (the purity of the product obtained, for example, at installations for converting natural gas is 95 to 99 percent)--is among the indubitable virtues of the electrolytic method for preparing hydrogen. The deficiencies of this method can include the high cost and metal intensiveness. Thus, the cost of electrolytic hydrogen is about 2.5-fold that of the cost of hydrogen obtained from natural gas, and this is determined mainly by the cost of electricity. The economists calculated that if, in the long term, all the hydrogen required were obtained by electrolysis at today's level of development of its production, not enough metal for this purpose would be smelted in the country by that time. One of the methods for raising the efficiency of electrolysis is to raise the temperature to 1,000 degrees C. At this time, the best developed technology operates on temperatures of ≈100 degrees C. Moreover, conversion to the electrolysis of sea water because of the substantial content therein of calcium and chloride-ions is not at all clear.

4. The Plasma-Chemical Method for Decomposition of Water [5]. From the overall physical point of view, the advantages of realizing the chemical transformations in the gaseous phase are obvious. The volumetric nature of the chemical processes that occur in a gas or plasma is considerable. High volumetric speeds of flow and great speeds of homogeneous reactions in the gaseous phase will enable high productivity to be achieved in systems that are technically simple to realize. This feature distinguishes positively plasma-chemical methods for obtaining energy carriers (hydrogen and oxides of carbon) from other electrical methods, particularly from the electrolysis both of a liquid phase and of a high-temperature phase with a solid electrolyte. It is an important feature of the use of nonequilibrious plasma-chemical processes that the energy contribution of the discharge is concentrated on separate levels

of freedom of the molecule and on the prescribed channels of the reactions. For this reason, the warmup of the gas is, as a whole, usually insignificant, and, consequently, the heat losses and the losses connected with reverse reactions are small. Thus, the possibility of achieving high energy efficiency (up to 80 percent) at comparatively low inlet temperature of the gas, as well as high specific productivity, distinguish the plasma-chemical method favorably from other chemical methods examined. Let us dwell on a discussion of this method in more detail.

There are in nature many different forms for the existence of a plasma and, correspondingly, there are also many variants for realizing plasma-chemical systems. A detailed analysis of the existing possibilities indicates that, from the point of view of energy expenditure and productivity, nonequilibrious processes that are accomplished in a weakly ionized plasma of reduced pressure through the fluctuating, excited states of reactants are optimal [8 and 9].

Sufficiently general considerations lead us to choose optimal parameters for the existence of such a plasma, namely, average energies (we shall arbitrarily call them temperatures) of the electrons should exceed considerably the temperatures of the gas: $T_e >> T_o$. That same condition should also occur for the fluctuating temperatures of the gas molecules: $T_v >> T_o$. Moreover, sufficiently high demands should be made on the degree of ionization of the plasma for maintaining the existing nonequilibriousness.

The conditions formed lead to the choice of two possible methods for obtaining molecular hydrogen:

1. The direct decomposition of steam:

$$H_2O \rightarrow H_2 + {}^1/_2O_2; \quad \Delta H = 2{,}6 \quad \text{ev/mol, and} \tag{2}$$

2. The two-stage carbon-dioxide cycle:

$$\begin{aligned} CO_2 &\rightarrow CO + {}^1/_2O_2; \quad \Delta H = 2{,}9 \quad \text{ev/mol,} \\ CO + H_2O &\rightarrow CO_2 + H_2; \quad \Delta H = -0{,}4 \quad \text{ev/mol,} \end{aligned} \tag{3}$$

when the carbon dioxide is decomposed at the first stage, and hydrogen is obtained at the second stage from carbon monoxide through steam conversion. Let us examine each of these processes.

1) The Direct Decomposition of Steam [8]. A higher efficiency of decomposition should be expected with such systems, where the temperature of the electrons is not sufficient for intensive excitation of electron states and the main share of the energy applied to the discharge of energy goes to the excitation of fluctuating degrees of freedom of the water and to dissociative attachment of the electrons to the water molecules. In such cases, in order to obtain high efficiency, very rigid requirements are imposed on the degree of ionization of the plasma: $n_e/N_o > 3 \cdot 10^{-4}$, since, first, the constant of the speed of pumping up of the fluctuations by electron collision is not

great enough, and, second, the constant of the speed of relaxation of the water molecule is very high. Achieving such a high degree of ionization where $T_e \sim 1\text{-}3$ eV is a task that is difficult to execute under conditions for all types of independent discharges. It has been established experimentally in an SVCh- [superhigh frequency-] discharge that the efficiency of such a process can reach 30-40 percent where the degree of ionization $n_e/N_o \approx 10^{-5}$.

2) The Two-Stage Carbon Dioxide Cycle [5 and 9]. The more important stage here is the first--the dissociation of CO_2, since the conversion of steam does not require large energy investment and can be realized in practice with comparatively simple means.

Comparative evaluations indicate the attractiveness of dissociation precisely of carbon-dioxide gas in an unequilibrious plasma. In the first place, the constant of the speed of fluctuating excitation of the CO_2 molecule by electron collision is strong enough (by more than an order of magnitude it exceeds the constant of the speed of fluctuating excitation of steam), and, in the second place, the speeds of CO_2 molecule relaxation are low. All this provides for a high degree of fluctuating excitation of CO_2 under the conditions of a nonequilibrious plasma which greatly exceeds the degree of fluctuating excitation under equilibrious conditions. The unique properties of the CO_2 molecule such as these, it can be said, also provide under nonequilibrious conditions an effective inversion of the population of its fluctuational levels, and, as a consequence, powerful laser generation.

An analysis of the energy balance, taking into account all the processes that influence the system's full efficiency, has indicated that the fluctuating excitation of CO_2 permits 80 percent of the energy invested in the discharge to be concentrated on conduct of the reaction of dissociation of carbon dioxide gas (the experimentally achieved effectiveness in an SVCh-discharge also is 80 percent). By way of comparison, the equilibrious process of thermal decomposition of CO_2 is marked by a maximum of computed process efficiency of 43 percent (the experimentally achieved efficiency obtained on an electric-arc plasmatron is about 15 percent) [9].

The excitation of an antisymmetric mode (00^01) of CO_2 fluctuations, for which, given a low-temperature plasma, the values of the parameter $E/N_o = 1\text{-}3 \cdot 10^{-16}$ $V \cdot cm^2$ (10) are required, that is, the fields $E \gtrsim 300\text{-}500$ V cm must be realized where the gas pressure in the reactor is 50-100 Torr, is more effective for conducting the reaction of CO_2 dissociation. Such field intensities in the plasma are realized relatively simply in stationary VCh-[high frequency-] and SVCh-discharges. Moreover, it is necessary to provide a sufficiently high degree of ionization in the discharge $n_e/N_o > 3 \cdot 10^{-6}$, which also can be accomplished in such discharges. Low values of the inlet temperature $T_o < 10^3$ K, which are characteristic for SVCh discharge at pressures of less than a hundred Torr, provides stability of the product in relation to the reverse reaction and low speed of the inlet fluctuation relaxation. Thus, the SVCh-discharges of reduced and average pressures are convenient for creating plasmas under conditions that are favorable for dissociating CO_2 through a fluctuating excitation of the molecule.

A functional scheme for realizing a two-stage plasma-chemical cycle is shown in figure 2. Figure 3 shows the scheme for a plasma-chemical reactor [11]. It is evident from these schemes that, after providing for separation of the gaseous components with recirculation of the carbon dioxide, we get a plasma-chemical cycle, the total result of which is a highly productive and economical process for decomposing steam into oxygen and hydrogen.

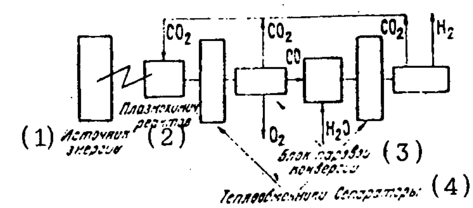

Figure 2. The Technological Chain for a Two-Stage Carbon-Dioxide Cycle.

1. Energy source.
2. Plasma-chemical reactor.
3. Steam-conversion unit.
4. Heat-exchangers of the separators.

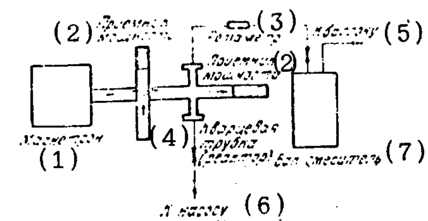

Figure 3. Functional Diagram of an SVCh [Superhigh Frequency] Plasma-Chemical Reactor.

1. Magnetron.
2. Power accumulator.
3. [Illegible.]
4. Quartz pipe (reactor).
5. To the tank.
6. To the pump.
7. Mixing tank.

We now face the problem of optimizing the two-stage cycle, which incorporated a large number of tasks: first, a search for ways to raise the experimental value (~80 percent) now achieved of the energy efficiency of dissociating carbon dioxide; second, increase in specific productivity and energy efficiency of separation in installations that separate carbon-dioxide dissociation products; and third, optimize the unit that converts carbon oxides into hydrogen. Moreover, scaling up the plasma-chemical unit, that is, increasing its capacity while retaining its energy efficiency, is important and urgent. The solution of this problem involves studies of the kinetics of elementary processes in the carbon-dioxide cycle's energy and of the process of the forming of the volumetric characteristics of the charge by searching for optimal schemes for organizing it.

An analysis of the literature's data makes it possible to obtain the characteristics of the two basic methods for obtaining the energy carrier--electrolytic and plasma-chemical--in accordance with the main characteristics for comparison: the energy efficiency, specific productivity and raw-material costs.

It has been shown experimentally that 4-5 kWh of electricity are consumed in forming 1 m^3 of hydrogen under the plasma-chemical method [9 and 11]; while with low-temperature electrolysis of water, about 6 kWh of electricity is spent in obtaining 1 m^3 of hydrogen because of the polarization of the oxygen electrode [12]. The energy efficiency of electrolysis can be raised by sharply reducing the polarization effects with increase in temperature. Such high-temperature electrolysis systems enable high energy effectiveness to

be estimated--4.5 kWh of electricity per 1 m^3 of hydrogen when delivering water in the form of steam at a temperature of ~850 K [13]. However, despite this, such installations, by virtue of their heterogeneous nature, have limited productivity per unit of surface. The process can be provided with the necessary productivity only by a layout of a large number of units, which can entail strong instability of operation of the system as a whole.

Moreover, high-temperature electrolytes are metal-intensive and require the use of a special solid electrolyte, for example, ZrO_2-Y_2O_3. Such an electrolyte is costly, as a rule, since the necessary conductivity is provided by using scarce materials and complicated technology.

Thus, the plasma-chemical method of obtaining hydrogen is advantageous mainly because of high specific productivity, low metal intensiveness and simplicity of technological implementation of the appropriate processes (for a plasma-chemical reactor of 100 kW power and a productivity on the order of 25 m^3 of hydrogen per hour, the working plasma volume is ~ 20 cm^3).

One cannot help but note the attractiveness of using plasma-chemical systems from the point of view of the process's ecological purity: the hydrogen and oxygen are produced from water practically without any kind of combustion or use of organic compounds. Finally, the problem of extracting and transporting fuel to the place of use disappears completely because water is the fuel.

Everything that has been said testifies to the promise of nonequilibrious plasma-chemical systems for obtaining hydrogen.

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GENERAL

BRIEFS

DEVELOPMENT OF YAMBURG FIELD--Yamalo-Nenets Autonomous Okrug--The builders of the Yamburg field have arrived to construct a town. The site for it was selected within the Tazov Peninsula, 5 kilometers from the shore of Obskaya Guba. The first object will be the housing complex for 400 persons. "Implementation of the general plan for development of Yamburg will begin here," said the chief engineer of the project, specialist of the Donetsk Institute YuzhNIIgiprogaz [not further identified] G. Shemrayev, whom the TASS correspondent met at the site of the future settlement. "The plan encompasses all aspects of development of the gas depot. Fifteen scientific research and planning institutes are participating in development of it." G. Shemrayev is a longtime resident of Western Siberia. He participated in development of the Medvezhye, Vyngapur and Urengoy fields. "But Yamburg conditions are more complicated than the others," he explains. "The main fraction of expenditures will go to auxiliary facilities rather than to construction of the fields themselves." For example, every fifth ruble will be expended on laying roads alone. The reason is the absence of construction materials. Yamburg is a large construction project even for the Western Siberian energy complex. The problem of all its participants is to take Yamburg gas within the shortest deadlines and with the least expenditures. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 6 Jun 84 p 1] 6521

CHIMKENT OIL REFINING PLANT--(TASS)--The builders have determined an intensified schedule for construction of the first unit of the Chimkent Oil Refining Plant. Only a week was required of the installers instead of the month according to the norm to complete assembly of the 50-meter rectification column, raised and installed on its foundation. The volume of work of the installers has increased 1.5-fold compared to last year's rate--the lage permitted earlier due to incomplete delivery of equipment had to be eliminated. A daring engineering solution was required in order to cope within compressed deadlines. The brigade of V. Mityukov suggested that related workers lay the heat insulation on the previously assembled structure. The collectives of the machine shops and bases of the trust maintained and developed the given acceleration during subsequent operations. They shipped finished assemblies instead of standard sets of pipe to the construction site. The rates will make it possible to begin refining of oil coming through one of the country's longest pipelines, the Omsk-Pavlodar-Chimkent, this year. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 May 84 p 1] 6521

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